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Some Reptiles and Amphibians From Trinidad

By W. GARDNER LYNN

The collection upon which this account is based was made in the course of a brief stay in Trinidad (17-24 August 1953) during the author's tenure as a Fulbright Scholar at the University College of the West Indies. The island of Trinidad lies a few miles off the northeastern coast of Venezuela and, as is well known, its faunal relations with the South American mainland are very close. No comprehensive account of the herpetology of this island is available, but there are useful lists and notes on many of the reptiles and amphibians found there: Mole and Urich (1894a, 1894b), Mole (1924), Roux (1926), Lutz (1927, 1928), Burt and Burt (1933), Parker (1933, 1935), Johnson (1946), and Beebe (1952). All measurements in mm. Snout-vent length expressed "s-v" herein.

Bufo granulosus Spix

One male, 51.0 long, taken at night in a ditch at St. Augustine, Aug. 18. The thumbs show slight darkening, but no well-defined pads. The stomach contained only ants. Although common in Venezuela it does not seem to have been previously recorded from Trinidad.

Eupemphix pustulosus trinitatis (Boulenger)

Breeding at St. Augustine on the nights of Aug. 18 and 19. Eleven (9 males, 2 females) and several egg-masses were collected. Most males were calling when taken and all were sexually mature; length 26.5 to 31.0 av. 29.3. Both females 32.0, bodies distended with eggs. The males all have expanded, darkly pigmented vocal sacs and somewhat wartier backs than the females. The colorpattern in life was similar in the sexes: dorsum gray-brown; two irregular brown stripes on each side of mid-dorsal line behind scapular level; a broad brown blotch above each groin; brown cross-bars on dorsal surfaces of arms and thighs; throat dark; belly light with a few small brown spots. Both females and two males have a thin mid-ventral light line on the throat from chin to chest.

The eggs are unpigmented, about 1.0 and are laid in rounded frothy clumps 40.0 diameter, each containing approximately 300 eggs. All were apparently freshly laid, showing no cleavage furrows.

My field notes record the call as "a high-pitched ow-w-w, reminding

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one somewhat of the faint whine of a dog," a description which corresponds closely with Netting (1930), who has provided a full account of the breeding habits of this species in Trinidad and a description of the two color phases seen there. He notes that the species has been taken at Port of Spain, St. Augustine, Mt. St. Benedict, and Arima in northwestern Trinidad and at Guayaguayare at the southeastern tip of the island. Johnson (1946) has since recorded it from Tucker Valley in the northwestern peninsula. Discussion of its systematic status may be found in Netting (1930) and Parker (1933).

Phyllobates trinitatis Garman

Twenty-three (7 males, 12 females, 4 juveniles) were taken from small streams in the Northern Range: Blue Basin, Caura Royal Road near La Veronica, Lopinot Road north of Lopinot, Blanchisseuse Road at base of Morne Bleu. One male from Blue Basin and one from Morne Blue had tadpoles attached to their backs. Most of the tadpoles escaped but 7 were collected in one case and 2 in the other. Males from 19.5 to 23.0 (av. 21.1), females 21.0 to 24.5 (av. 23.2), juveniles 14.0 to 18.5. This frog shows striking sexual dichromatism: throat of female bright canary-yellow, that of male black. Detailed description of the colorpattern of a typical female in life is: back iridescent coppery brown with a dark brown blotch between eyes, brown blotches over scapulae and three smaller blotches behind scapular level; dark line from tip of snout through eye, broadening on sides to groin, but split posteriorly by a copper-colored line from groin halfway to fore limb; legs tan with black cross stripes on upper surfaces; belly and inner surfaces of limbs white; throat canary—yellow bordered posteriorly by a dark line; tinges of yellow in groin. The males, in addition to having black throats, tended to be darker than females, but in most cases a colorpattern like that of the female could be distinguished. One male, however, had a jet black back without pattern. Both males and females darkened considerably after preservation.

Several males were found calling. The call resembles a cricket's chirp and may be transliterated as "piti-piti-piti." The 9 tadpoles were all in the same stage of development although from two different broods. All have body length 4.5 and tail 8.0; none has visible hind limb buds. The tadpole at this stage has eyes dorsal in position, not visible from ventral aspect; upper border of eye on a level with, and directly behind nostril; spiracle small, sinistral, lying laterally, approximately on horizontal axis of body; vent dextral; tail fins tapering uniformly without spatulate broadening and not extending onto body; labial disk emarginate at sides; lower labium completely bordered with papillae; upper labium with papillae at sides, but with central third smooth; two upper labial tooth ridges, the innermost interrupted by a small gap at its center: two lower labial tooth ridges; horny beak about two-thirds as long as first row of upper labial teeth.

The subject of tadpole-carrying males in *Phyllobates* and related genera has been interestingly reviewed by Dunn (1941). Boulenger (1895) seems to have been the first definitely to establish that this habit occurs in *trinitatis*. Earlier, however, Boettger (1893) had remarked that this is probably the case and suggested that the absence of the bright yellow chin in the male is an adaptive modification serving for concealment of

the sex which is burdened with the care of the young. Breder (1946) has good figures of tadpole-carrying in *Phyllobates talamancae* and *Dendrobates auratus*.

Leptodactylus sibilatrix (Wied)

One collected on road at night during heavy rain near La Veronica; length 45.5. In life the back light brown with dark line extending posteriorly from eye along sides; irregular dark splotches between eyes, over scapulae, and in middle of back; groin and thighs yellowish, throat and belly white.

Mabuya mabouya mabouya (Lacépède)

One from cocoanut litter in the Cocal on Manzanilla Bay, Aug. 21; s-v 89.5, tail 157.0. Colors in life: back coppery brown with small irregular black spots; a dark brown lateral line from snout onto tail; belly, throat and under side of tail yellow; hands and feet dark. Preservation has turned the back dark brown so that the spots are now visible only at the sides whereas a lighter line, not noted during life, extends from the angle of jaw above fore limb to groin; ventral surfaces uniform slate.

Gonatodes vittatus (Lichtenstein)

Abundant in the litter beneath cocoanut trees along Manzanilla Bay. Nineteen (7 males, 10 females, 2 juveniles) were captured in less than an hour Aug. 21, and many more were seen. The males are very near one size (s-v 31.5 to 32.0), but females show a greater range (29.5 to 33.0). Tail length is variable (males 35.0-43.0; females 30.0-40.0). In several a single large egg can be seen through the body wall.

Colorpattern of males in life: chalk-white line with thin border of black about 1.0 wide, along mid-line from snout to base of tail, darkening gradually on tail; sides and upper surfaces of limbs and tail ocher; belly purplish-black; under sides of legs and tail dark brown; throat and chin bright yellow. Females: faint light-brown mid-dorsal line; back dusky brown with rows of alternating black and white spots on each side of mid-dorsal line and less regularly arranged spots on sides; belly and under surfaces of legs and tail gray; throat gray. Two juveniles (s-v 17.5 and 23.0) have the female color pattern. The marked sexual dichromatism is well known. Parker (1935) says, "It seems probable that males also undergo a seasonal change of colour. Sometimes the chin and throat are uniform white but in other examples there is a bold pattern of black and white. This consists of a central white Y or V, heavily outlined in black, and parallel with the edge of it are a series of white blotches all strongly outlined in the same way. No observations appear to have been made to ascertain when this character is developed and when lost; specimens collected on Mt. St. Benedict by Mr. Vesey Fitz Gerald in April have it well marked." As noted above, the males in my collection all had bright yellow throats in life, darkened after preservation to unmarked gray or brown.

The colorpattern of *vittatus* from Trinidad and from neighboring portions of the mainland has been discussed by Stejneger (1901), Roux (1926), Burt and Burt (1931), Beebe (1944) and Marcuzzi (1951).

Sphaerodactylus molei Boettger

Three females were taken in The Cocal at Manzanilla Bay. Two are s-v 23.5 and both of these have lost their tails. The single perfect speci-

men s-v 24.0, tail 28.0. Colorpattern in life: back plain brown; two conspicuous white bands on head beginning behind tip of snout, extending above eye onto side of head, ending abruptly just anterior to fore limbs; a blotch of white between eyes dividing into two lines posteriorly, converging again at back of head, forming a diamond-shaped marking; upper and lower lips, light brown; belly white; under side of tail orange; throat yellow. One smaller specimen showed this pattern, but the other differed in having light lateral lines extending along body and onto tail.

This species was described by Boettger (1894), the type locality Caparo, Trinidad. Barbour (1921) provided a detailed diagnosis and description of a specimen in the Museum of Comparative Zoology and remarked that the species seemed decidedly rare. However, Beebe (1952) records it as common in the Arima Valley. Roux (1926) gave an account of the color patterns in three males and one female. It has since been found on the mainland. Observations on habits and color patterns of *molei* in Kartabo, British Guiana, have been given by Beebe (1944). Shreve (1947) referred *venezuelanus* Roux to *molei* and discussed the color pattern and scalation of 10 Venezuelan specimens.

Scolecosaurus trinitatis Barbour

Two taken, one beneath a stone at the roadside, Caura Royal Road near La Veronica, August 18, and one in cocoanut trash, The Cocal, Manzanilla Bay, August 21. Both had purplish-black tails, light brown backs with lateral light lines extending onto tail, dark brown sides and light bellies; lateral lines one scale wide, separated by six rows of scales; five rows of scales below each light line, between the light line and the white belly scales; latter in 7 to 8 rows across central part of body, 3 or 4 rows anteriorly and posteriorly.

For descriptions of variations in scalation see Roux (1926) and Burt and Burt (1931). *S. trinitatis* is apparently also found on the mainland, in the valley of the Orinoco River (Barbour, 1933; Brongersma, 1946).

Atractus trilineatus Wagler

One found beneath a flower-pot on a lawn in St. Augustine Aug. 18. In life the back was uniform slate and the belly pink; s-v 172.0; tail 12.0; 15 scale rows, 144 ventrals, 16 caudals.

Ninia atrata (Hallowell)

One male beneath stone at roadside on Morne Bleu, 2000 feet, Aug. 20. In life, back grayish-brown with reddish-yellow band about 4.0 wide just behind eyes; venter immaculate white; s-v 280.0, tail 85.0; 19 scale rows, 151 ventrals, 59 pairs of caudals; 8 upper labials on right, 7 on left.

LITERATURE CITED

Barbour, T. 1921. Sphaerodactylus. Mem. Mus. Comp. Zool. 47: 217-278.

1933. Notes on Scolecosaurus. Copeia 1933: 74-77.

Beebe, W. 1944. Field notes on the lizards of Kartabo, British Guiana, and Carapito, Venezuela. I Gekkonidae. Zoologica, 29: 145-160.

1952. Introduction to the ecology of the Arima Valley, Trinidad, B.W.I. Zoologica 37: 157-184.

Boettger, O. 1893. Reptilien und Batrachier aus Venezuela. Ber. Senckenberg Naturf. Gesellsch. 1893: 35-42.
1894. See Mole, R. R. & F. W. Urich 1894a.
Boulenger, G. A. 1895. On the nursing-habits of two South American frogs. Proc. Zool Soc. London 1895: 209-210.
Breder, C. M., Jr. 1946. Amphibians and reptiles of the Rio Chucunaque drainage, Darien, Panama, with notes on their life histories and habits. Bull. Am. Mus. Nat. Hist. 86: 375-436.
Brongersma, L. D. 1946. Some notes on species of the genera Bachia and Scolecosaurus. Zool. Mededeel. Leyden 26: 237-246.
Burt, E. E. and M. D. Burt. 1931. South American lizards in the collection of the American Museum of Natural History. Bull. Am. Mus. Nat. Hist. 61: 227-395.
Burt, C. E. and M. D. Burt. 1933. A preliminary check list of the lizards of South America. Trans. Acad. Sci. St. Louis 28: 1-104.
Dunn, E. R. 1941. Notes on *Dendrobates auratus*. Copeia 1941: 88-93.
Johnson, M. L. 1946. Herpetological notes from Trinidad. Copeia 1946: 108.
Lutz, A. 1927. Notes on batrachians from Venezuela and Trinidad. Mem. Inst. Oswaldo Cruz 20: 35-65.
1928. Estudios de zoologia y parasitologia venezolanas. 133 pp. Rio de Janeiro.
Marcuzzi, G. 1951. Osservazioni sulla sistematica e variabilita di alcune specie di lucertole (Rept., Lacertilia) del Venezuela. Arch. Zool. Ital. 36: 17-56.
Mole, R. R. 1924. The Trinidad snakes. Proc. Zool. Soc. London 1924: 235-278.
——— and F. W. Urich. 1894a. A preliminary list of the reptiles and batrachians of the Island of Trinidad. With descriptions of two new species by O. Boettger. Jour. Trinidad Field Nat. Club 2: 77-90.
1894b. Biological notes upon some of the Ophidia of Trinidad, B.W.I., with a preliminary list of the species recorded from the island. Proc. Zool. Soc. London 1894: 499-518.
Netting, M. G. 1930. The systematic status and breeding habits of *Eupemphix trinitatis* Boulenger. Ann. Carnegie Mus. 19: 249-254.
Parker, H. W. 1933. A list of the frogs and toads of Trinidad. Trop. Agric. (Trinidad) 10: 8-12.
Parker, H. W. The lizards of Trinidad. Trop Agric. (Trinidad) 12: 65-70.
Roux, J. 1926. Notes d'erpétologie sud-américaine. 1. Sur une collection de Reptiles et d'Amphibiens de l'ile de la Trinité. Rev. Suisse Zool. 33: 291-299.
Shreve, B. 1947. On Venezuelan reptiles and amphibians collected by Dr. H. G. Kugler. Bull. Mus. Comp. Zool. 99: 519-537.
Stejneger, L. 1901. An annotated list of batrachians and reptiles collected in the vicinity of La Guaira, Venezuela, with descriptions of two new species of snakes. Proc. U.S. Nat. Mus. 24: 179-192.

DEPARTMENT OF BIOLOGY,
THE CATHOLIC UNIVERSITY OF AMERICA

SOME ALTITUDE RECORDS OF REPTILES AND AMPHIBIANS.—During the course of field work in the mountains of North Carolina, I have recorded the maximum elevations at which certain reptiles and amphibians were noted. More recently I have noticed a paucity of published information of this sort and regretted that I had not made notes on more species. The following records, however, may be noteworthy: June 10, 1956, northeast of Roan Mountain, Tennessee-North Carolina, Fowler's Toad (*Bufo fowleri*), 4900 feet, and Garter Snakes (*Thamnophis sirtalis*), ranging up to 5100 feet; June 13, 1957, near Fairview, N. C., Black Racer (*Coluber constrictor*) at 2950 feet; June 3, 1958, Pisgah Ridge, N. C., Ring-necked Snake (*Diadophis punctatus*) at 6000 feet. Elevations were determined by the use of U. S. Geological Survey maps or a Taylor altimeter and are believed to be within 50 feet of accuracy. No specimens were taken, therefore subspecific identifications could only be surmised on the basis of geography.—*Henry M. Stevenson, Biological Sciences Dept., Florida State Univ., Tallahassee, Florida.*

CLASPING BEHAVIOR OF THE LEOPARD LIZARD.—While out with a group of students in Skull Valley, central Tooele County, Utah, May 22, 1937, we noted that a leopard lizard, *Crotaphytus wislizeni wislizeni* Baird and Girard, had just emerged at 8:20 a.m. into the sunshine from its overnight underground retreat and was still sluggish. When captured, it felt cool to the hand.

Ten minutes later, at 8:30 a.m., we found a pair in clasping position. Tracks in the sand indicated that they had come together from different directions near the place where found and had not moved far since meeting and were probably cool. When first observed in an open sandy space between sagebrush bushes, they ran about thre feet and stopped in a sunny spot. The male was clasping the female just in front of the hind legs, his nose reaching to her shoulder. His hind legs were astride her tail which was stretched out straight behind. His tail, by contrast, turned at right angles under hers. While running, the male kept his clasping position, running with hind legs only, with his tail straightened alongside that of the female.

The pair appeared to be somewhat sluggish in the manner of lizards getting warm in the morning sunshine. They remained almost motionless for a half hour before they were again disturbed. Upon my closer approach, the female turned her head quickly and appeared to be alert to the presence of an intruder, but the male paid no attention. Again, they remained motionless in the sunshine except for one or two twitches of the male's tail for at least a half hour.

A slow cautious approach seemed not to disturb them until an awkward move of the hand at a distance of three feet brought a response. They moved about six inches, the male straightening his tail as they moved. A short time later, when disturbed by another quick movement, they ran into a bush where they were partly concealed. They remained in the clasping position while under observation, a total of one and one-half hours. When approached several times, they ran short distances but showed no hint of unclasping. With a small pocket tape measure, they could be stroked without obvious objection.—*Angus M. Woodbury, Salt Lake City, Utah.*

Distributional Records for Certain Mexican and Guatemalan Reptiles

By ERIC R. PIANKA and HOBART M. SMITH

During the summer of 1958 the senior author with Stephan Burch and Jerry Torrence hastily traveled a number of roads in Mexico and Guatemala. In the time available, about 50 reptiles were secured and noteworthy records are here reported. All specimens are in the senior author's collection, except a few which have been donated to the University of Illinois Museum of Natural History (UIMNH).

Species taken within established range limits are *Hemidactylus frenatus* (Hotel Acapulco, Acapulco, Gro.); *Anolis nebuloides* (20 km. N Tehuantepec, Mex. Hy. 90, Oax.); *Ameiva undulata dextra* (5 km. E Atoyac, N Acapulco, Gro.); *Cnemidophorus d. deppei* (Salina Cruz, Oax.); *Loxocemus sumichrasti* (92 km. NW Acapulco, Mex. Hy. 200, Gro.); *Leptophis d. diplotropis* (64 km. NW Acapulco, Mex. Hy. 200, Gro.); *Masticophis m. mentovarius* (betw. Santiago Tuxtla and Ciudad Zerde, 100 km. SE Veracruz, Mex. Hy. 180, Ver.); *Pituophis deppei jani* (70 km. S Saltillo, Mex. Hy. 57, N.L.); *Salvadora mexicana* (5 km. E Ciudad Altamirano, Mich.); *Sibon nebulatus* (35 km. W Cárdenas, Mex. Hy 20, Tabs.); *Crotalus atrox* (42 km. S Jiménez, Chih.; N El Sueco, Mex. Hy. 45, Chih.); and *Crotalus i. intermedius* (16-24 km. W Jalapa, Ver.).

Anolis crassulus Cope. An adult female (UIMNH 46526) is from the second known locality (and the first precise one) in Mexico: betw. Teopisca and Comitán, Chiapas, July 25, on a rocky slope in a pine forest. Like most females reported by Smith and Kerster (1955, Herpetologica, 11: 198) a light vertebral stripe is present.

Cnemidophorus gigas Davis and Smith. A typical adult male, 110 mm. s-v, 23-23 femoral pores, 3 km. N Río Balsas on the Iguala-Chilpancingo road (Mex. Hy. 95). Davis and Smith (1952, Herpetologica, 8: 97-100) record the species only from extreme northern Guerrero near Taxco, although its range probably embraces much of the lower and central Balsas basin.

Enyaliosaurus clarki (Bailey). Duellman and Duellman (1959, Occ. Pap. Mus. Zool. Univ. Michigan, 596, 1-10) reviewed this species. Previous records have been restricted to the arid Tepalcatepec valley of Michoacán. A subadult female (UIMNH 46527) from within 8 km. of the Río Balsas 32 km. E Huetamo, Michoacán, extends the known range eastward along the Balsas River, nearly into Guerrero, and suggests that the range of *clarki* actually may embrace extensive areas in the lower arid basin of the Balsas River and its tributaries.

The specimen agrees well with the Duellman description and also with Bailey's figures (1938, Proc. U.S. Nat. Mus., 73). Coloration and scutellation seem to be largely within the expected range of variation of a single taxonomic population. The lamellae on 4th toe are 32-34, exceeding by one Duellman's maximum of 33, middorsals 94, visibly enlarged virtually to level of sacrum; femoral pores indistinguishable; dorsal scales on caudal whorls 9; tail/body ratio 1.02 (96 mm. s-v, 98 mm. tail). Both Bailey and the Duellmans state that the middorsal crest extends only 2/3 length of body and this is the only peculiarity of possible taxonomic sig-

nificance we can discern. We have no topotypic *clarki* for comparison, but Bailey's plate shows the crest in the type visible almost as far posteriorly as in the present specimen. We thus assume that no real difference exists despite the discrepancy between descriptions and our specimen.

Field notes state: "Very dry, arid country. Found within a live hollow tree."

Phrynosoma orbiculare orientale Horowitz. An adult female (UIMNH 46528) was found in a juniper-cactus-mesquite desert, N of Providencia and W of Bella Unión, at about km. 815-820, within the border of the state of Coahuila, whence the species has not been reported. The range recorded by Horowitz (1955, Amer. Midl. Nat., 54: 204-218) is extended only slightly to the northwest.

Sceloporus horridus oligoporus Smith. An adult male and a female were taken July 8 in Michoacán, between Huetamo and Ciudad Altamirano, Guerrero, Balsas. They have 3-3 and 2-3 femoral pores respectively; male with a well-developed pattern on venter. These verify the occurrence of this race in extreme SE Michoacán.

Sceloporus malachiticus taeniocnemis Cope. An adult female with 47 dorsals from between Teopisca and Comitán, Chiapas, July 25, on a rocky slope in a pine forest, in the same locality and ecological habitat as *Anolis crassulus*.

Drymarchon corais unicolor Smith. A subadult female, DOR 32 km. E of the western border of Chiapas on Mex. Hy. 190 (pan-American), 892 mm. s-v, 273 tail, is uniform brown over the entire length of body, except for dark streaks at the margins of numerous anterior scales and a large V-shaped dark mark, apex forward, just posterior to nape. It constitutes a range extension about 100 miles NW from southern Chiapas.

Masticophis striolatus striolatus (Mertens). Two, one from 2 km. N Acatlán, Puebla, the second recorded from the state (Smith and Van Gelder, 1955, Herpetologica, 11: 145-149) and the other from 3 km. N Río Balsas on Iguala-Chilpancingo road (Mex. Hy. 95).

Stenorrhina freminvillei apiata Cope. An adult male 16 km. SE of Chiapas border, on Guatemala highway 9 N, in the state of Huehuetenango, Guatemala. It was found on the road at night in cool rain forest, temp. approx. 80° F., alt. about 3000 ft. The pattern is uniform brownish slate above, with a dark spot at the base of each scale. Curiously, *S. f. freminvillei* has been reported from SE Guatemala and El Salvador and *S. f. lactea* from El Salvador, but we are not aware that *apiata* has previously been recorded in SW Guatemala.

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A Pleistocene Herpetofauna Near Orange Lake, Florida

By J. ALAN HOLMAN

This report is based upon specimens collected from a new Pleistocene locality, discovered by Dr. Pierce Brodkorb of the Department of Biology of the University of Florida, July 31, 1957. The locality is of special interest because vertebrate bones occur not only in clays of Illinoian age, but also in the overlying Wicomico terrace.

The fossil deposit is situated in a solution sink in a limestone quarry near the center of sec. 33, T 12 S, R 21 E, Marion County, Florida, two miles south of the town of Orange Lake at a surface elevation of approximately 100 feet. Dr. Brodkorb measured the following section at the bone bed at the time of its initial excavation.

Bed 1: Pleistocene series, Wicomico formation; dark reddish brown, massive sandy clay; with vertebrate bones occurring near middle of bed; 16 feet.

Bed 2: Pleistocene series, Wicomico formation, Arredondo member; blue clay streaked with yellow; contains fresh water snails, scutes of *Dasypus bellus,* and vertebrate bones; 13 feet.

Bed 3: Eocene series, Ocala formation; white, soft, friable limestone; contains fossils of marine invertebrates.

The Wicomico terrace represents a marine formation deposited during the Sangamon interglacial stage of the Pleistocene (Cooke, 1945). The underlying Arredondo clay presumably represents the Illinoian glacial stage of the Pleistocene (Brodkorb, 1959).

The Pleistocene animals were trapped in the sink which evidently filled with sediments during Illinoian time. Later in the Pleistocene epoch the sediments and bones were covered by the Wicomico sea. I do not believe that the bones from the Wicomico terrace represent animals of Sangamon age, but rather they were reworked from the top of the Illinoian bed by the encroaching sea. Substantiating this are numerous turtle remains from the Wicomico terrace, so fragmentary that generic identification is impossible.

The associated fauna consists of rather small birds and mammals, including: *Colinus* sp. (extinct quail), Passeriformes indet., Soricidae indet., *Sylvilagus floridanus, Neofiber alleni, Pitymys* sp., *Sigmodon hispidus, Peromyscus* sp., and *Dasypus bellus.*

The following reptilian and amphibian fossils have been deposited in the vertebrate collections of the Florida Geological Survey, Tallahassee, Florida. With the exception of one *Ambystoma* vertebra, all are from the Arredondo clay member. I would like especially to thank Miss Jane Larson for making the drawing.

Ambystoma tigrinum Green

Nine vertebrae (FGS V-5824). Although the vertebrae of the species of *Ambystoma* are exceedingly similar, the above vertebrae are assigned to the species *A. tigrinum* on the basis of size. The length of the fossil vertebrae through the zygapophyses ranges from 4.5-5.6 mm. In Recent adult *A. tigrinum,* the length through the zygapophyses ranges from 4.9-5.3 mm. In Recent adult *A. texanum, A. talpoideum,* and *A. cingulatum,* the length through the zygapophyses ranges from 3.1-3.4 mm. One of

these large vertebrae is from the Wicomico formation.

Ambystoma sp.

Seventeen vertebrae (FGS V-5825). Because of their small size, they may represent either young *tigrinum* or a smaller species of *Ambystoma.*

Plethodon glutinosus Green

Seven vertebrae (FGS V-5826). *Plethodon glutinosus* is known also from a Wisconsin deposit in Florida (Holman, 1958).

Scaphiopus holbrooki Harlan

Five left and two right ilia (FGS V-5827).

Bufo terrestris Bonnaterre

Three right and six left ilia (FGS V-5828).

Microhyla carolinensis Holbrook

One left and one right ilium (FGS V-5829).

Rana sp.

Twelve right and 18 left ilia, and one fragmentary sacral vertebra (FGS V-5830). Tihen (1954) has pointed out that the sacral vertebra is useful in determining the species groups of *Rana.* The fossil sacral, however, is so fragmentary that it cannot be utilized. The overlap among ilial characters in the species of *Rana* is very great. There is a tendency for the dorsal angle of the acetabular expansion to be more anteriorly directed in the *pipiens-clamitans-palustris* group than in the *catesbeiana-grylio-hecksheri* group. Most of the fossils fall into the former group in this character, but the difference is subtle. Since the fossils are small, it seems possible that they represent *pipiens,* in consideration of its Recent distribution.

Terrapene carolina Linnaeus

Left humerus (FGS V-5831). The humerus of *Terrapene* is characteristic. Auffenberg (1958) reports that all box turtles from the Pleistocene of Florida belong to the species *T. carolina.* The longest humerus of any Recent *carolina hauri* I have examined is 34.0 mm. and of Recent *carolina major* is 44.3 mm. The length of the fossil humerus is 38.8 mm., falling between the extremes of the Recent Florida subspecies. Shell and skull elements are needed for subspecific allocations.

Geochelone sp.

Right femur (FGS V-5832). The femur is that of a small *Geochelone.* It is distinct from the femur of *Gopherus,* its closest generic relative in the Pleistocene of Florida. At the proximal end, the trochanteric fossa is rounded, long, and very deep in *Gopherus.* In the fossil *Geochelone* it is oval, short, and very shallow (Table I). The head of the femur is much smaller and more flattened from side to side in *Gopherus* than in the *Geochelone* fossil. At the distal end the condyles are much more expanded and angular in *Gopherus* than in *Geochelone.* The entire bone is shorter and stouter in *Geochelone.*

Williams (1950) points out that Hay's species of *Testudo* from Florida (*distans* and *luciae*) are represented by such fragmentary remains that they should remain indeterminate until more material is accumulated. He recognizes the giant species *sellardsi* and *crassiscutata* as valid. A very small testudinid (*Floridemys nanus*) from the Pleistocene of Florida is considered incertae sedis by Williams. Loveridge and Williams (1957) propose that all Tertiary and Pleistocene tortoises of North America formerly considered *Testudo* should now be separated as *Geochelone.*

Bones of small tortoises are very numerous in Pleistocene deposits of Florida, and I tend to believe that they do not represent the young of the giant species, but a distinct smaller form of the genus *Geochelone*.

Alligator mississipiensis Daudin

One small tooth (FGS V-5835).

Anolis carolinensis Voigt

Five left and six right dentaries, and two right maxillae (FGS V-5836).

Ophisaurus ventralis (Linnaeus)

Fifteen vertebrae (FGS V-5837).

NATRICINAE indet.

Three fragmentary vertebrae (FGS V-5838).

COLUBRINAE indet.

Twenty fragmental and inseparable vertebrae (FGS V-5840).

Farancia or *Abastor*

One vertebra (FGS V-5839). Represents a medium sized individual.

Drymarchon corais Daudin

Fifty-nine vertebrae (FGS V-5844). Of such uniform size that they may represent a single individual.

Elaphe sp.

Four vertebrae (FGS V-5841). Indeterminate at the species level.

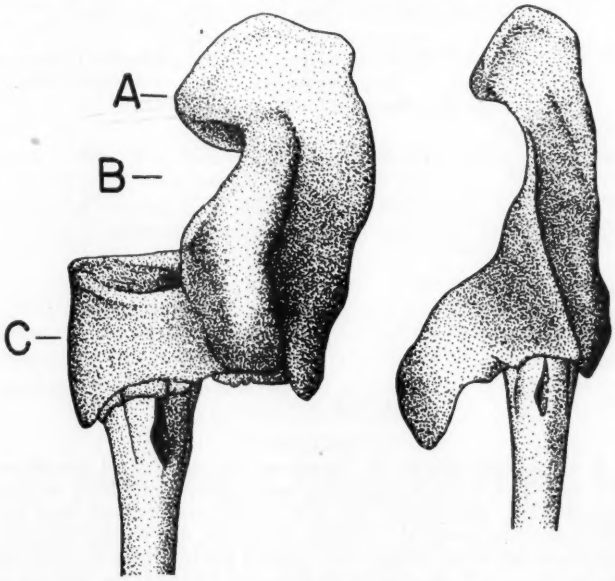

Fig. 1. Anterior aspect of right maxilla of *Crotalus adamanteus* (left), and *Ancistrodon piscivorus* (right). A, dorsal process; B, loreal fossa; C, ventrolateral process.

Lampropeltis getulus Linnaeus

Four vertebrae (FGS V-5842).

Micrurus fulvius Linnaeus

Six vertebrae (FGS V-5843).

Crotalus adamanteus Beauvois

Right maxilla (FGS V-5845). The vertebrae of *Crotalus* and *Ancistrodon* are extremely similar, but the maxillae of the two genera are distinct. In anterior aspect, the border of the loreal fossa is square in outline in *Crotalus*, but broadly rounded in *Ancistrodon* (Fig. 1). This is a reflection of the more downswept ventrolateral process. The dorsal process, which articulates with the prefrontal, exhibits a truncate ventrolateral border in *Crotalus*; this border is more acute in *Ancistrodon*. In *Crotalus* the dorsal process is large, robust, and has a broad neck, but in *Ancistrodon* it is much smaller, slender, and with a constricted neck.

The maxillae of *Crotalus* and *Sistrurus*, however, are similar, except for larger size in *Crotalus*. At the specific level, *adamanteus* may be separated from *horridus* by the notch on the ventrolateral border of the neck of the dorsal process. In *adamanteus* it is a roughened knob, but in *horridus* it forms a hook. The fossil agrees with *adamanteus* in the above character.

TABLE I

Femoral measurements (mm.) and ratios (per cent) of *Gopherus* and *Geochelone*.

	Gopherus polyphemus (five specimens)		*Geochelone* (Pleistocene) (one specimen)
	Range	Mean	
Length through head	41.4-51.3	43.74	43.0
Greatest width through head	7.3-14.2	11.5	14.4
Greatest length subtrochanteric fossa	4.0- 7.6	6.44	3.7
Greatest wides head ÷ greatest length through head	23.2-30.7		33.5
Greatest length subtrochanteric fossa ÷ greatest width head	52.0-60.8		25.7

DISCUSSION

It seems likely that in the Pleistocene the above fossil locality was a fairly large sink which was probably only intermittently filled with water since the sandy clay of the bone bed is well stratified and there are no fossil fish. Considering the ecology of present day Florida reptiles and amphibians, the fossil animals were derived partially from a marshy situation and partially from a better drained area. Perhaps the sink was on a gently rising knoll at the edge of a marshy prairie. *Rana* sp., *Alligator*, the natricines, *Farancia* and *Lampropeltis getulus* could have lived in this prairie, whereas *Ambystoma tigrinum*, *Plethodon glutinosus*, *Scaphiopus*

holbrooki, *Bufo terrestris*, *Microhyla carolinensis*, *Ophisaurus ventralis*, *Micrurus fulvius*, *Terrapene carolina*, *Elaphe* sp., *Drymarchon corais* and *Crotalus horridus* could have lived on the better drained area. Such an area can be seen today at Bolen Bluff at Paynes Prairie, south of Gainesville, Florida.

It has been postulated by Brodkorb (1957) that the Illinoian climate of Florida was similar to the present climate of North Carolina or Virginia. The above fossil fauna does little to prove or disprove this thesis. In fact, all the amphibians and reptiles are found in the same area of Florida today, with the exception of *Geochelone* which now has a more southerly distribution. This substantiates the growing evidence that the herpetofauna of Florida has been a rather stable unit, at least since the Illinoian stage of the Pleistocene. Evidently the distinct southwestern element in the Florida herpetofauna had reached Florida before this period. The herpetofauna also substantiates the evidence that the rate of extinction among Florida reptiles and amphibians has been much lower than among birds and mammals since the Illinoian stage.

LITERATURE CITED

Auffenberg, W. 1958. Fossil turtles of the genus *Terrapene* in Florida. Bull. Florida State Mus. 3 (2): 53-92.

Brodkorb, P. 1957. New passerine birds from the Pleistocene of Reddick, Florida. Jour. Paleont. 31: 129-138.

..... 1959. The Pleistocene avifauna of Arredondo, Florida. Bull. Florida State Mus. 4 (9): 269-291.

Cooke, C. W. 1945. Geology of Florida. Florida Geol. Surv., Geol. Bull. 29: 1-339.

Holman, J. A. 1958. The Pleistocene herpetofauna of Sabertooth Cave, Citrus County, Florida. Copeia (4): 276-280.

Loveridge, A. and E. E. Williams. 1957. Revision of the African tortoises and turtles of the suborder Cryptodira. Bull. Mus. Comp. Zool. 115 (6): 153-557.

Tihen, J. A. 1954. A Kansas Pleistocene herpetofauna. Copeia (3): 217-21.

Williams, E. E. 1950. *Testudo cubensis* and the evolution of western hemisphere tortoises. Amer. Mus. Nat. Hist. Bull. 95: 1-36.

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TICK INFESTATION OF WESTERN SPUR-THIGHED TORTOISES.—Last spring I inspected 94 recently imported *Testudo graeca graeca* from N. Africa (no exact collection data), of which 14 were adults and subadults, others juveniles and younger. Altogether 82 ticks were removed, 4 ticks escaping. The remaining 78 were all identified as *Hyalomma aegyptium* by Glen M. Kohls of National Institute of Allergy and Infectious Diseases. About three fourths of the collected arachnids were removed from the 14 larger tortoises, the top number of ticks on one specimen being 14.—*Arsene Eglis, 41-72 Denman, Elmhurst, N.Y.*

ELECTRIC TATTOOING FOR PERMANENT IDENTIFICATION OF FROGS.—Some of the problems encountered in marking cold-blooded animals are fading and toxicity of dyes, rusting or rejection of bands, and injury from the procedure (Dunn and Coker, Copeia, 1951, 1: 28-31).

The writer has reported (Herpetologica, 1958, 14: 131-132) that frogs may be identified for controlled periods by banding the toes with tiny commercial numeralized bird bands; they may be identified permanently by mechanically scarifying the whitish skin of the belly with a needle and running India ink into the scarified grooves.

The use of electric tattoo needles is an improvement upon the scarification technic, both in rapidity and the external pressure needed. Electric tattooing, which is common in mammals, has been done in fishes (Hickling, Jour. Marine Biol. Assoc. of the United Kingdom, 1945, 26: 166-169) and in reptiles (Woodbury, Copeia, 1948, 2: 127-128). The colored markings may be overlooked on the dark integument often found among the cold-blooded animals. This difficulty is not encountered in frogs, because of a sufficient expanse of whitish ventral skin.

The electric method is simple and is mastered at once. Any electric tattoo marker may be tried. We use a small portable model which works on any 110 volt A.C. outlet, with a step-down transformer in the circuit (Spaulding and Rogers Manufacturers, Jacksonville, N. C.). The needle selected must have a narrow point to write a relatively fine line on the frog's abdomen and permit the imprinting of several numerals or letters. The speed of vibration of the needle which produces optimal results should be determined.

Of the several dyes tried here, Higgins India ink is most effective. A drop of glycerin added to it may facilitate its spreading into the skin. Red, black, white and other tattoo colors are commercially available, but they have no unique advantages.

The surplus ink that flows around the primary markings during the tattooing activity is readily eradicated with a cloth, leaving the tattooed markings clear. There is no subsequent running of the marks and they are permanent. Frogs may show an initial transitory erythema, but only rarely gross evidence of prolonged local inflammation.

The upper abdomen is most readily tattooed. The area selected should first be wiped dry with absorbent cotton. The needle is then applied almost vertically to the skin, with a firm and uniform pressure, avoiding penetration into the deeper muscles. The procedure can be repeated if necessary.—*Harold M. Kaplan, Department of Physiology, Southern Illinois University, Carbondale.*

Notes on the Variation in and Distribution of the Mexican Colubrid Snake *Coniophanes lateritius*[1]

By JOHN WELLMAN

Coniophanes lateritius was described from "Guadalajara," Jalisco, by Cope (Proc. Acad. Nat. Sci., Phila., 1862, p. 524) and characterized as follows: ". . . body was bright vermillion punctulated with brown, passing through orange to golden on the belly. The head, and neck for ten scales posteriorly were black, the labials bordered and traversed by yellow lines, and the occipitals dotted with the same. Throat and chin yellow, black spotted." Peters (Monatsb. Akad. Wiss. Berlin, 1869: 876) described *Tachymenis melanocephala,* a form which was characterized by having a light, dark-edged collar four scales in length just posterior to the black head, no light spotting on the head, and a white throat bar anterior to the first ventral (Smith and Grant, Herpetologica, 1958, 14: 21). Bailey (Pap. Mich. Acad. Arts Lett., 1939, 24: 28-29) considered *Tachymenis melanocephala* to be a synonym of *Coniophanes lateritius.* Taylor and Smith (Univ. Kans. Sci. Bull., 1950, 33: 341) restricted the type locality of *T. melanocephala* to Izúcar de Matamoros, Puebla. Bailey (*op. cit.*) and Taylor (Univ. Kans. Sci. Bull., 1942, 27: 125-26, fig. 5) reported from Huajintlán, Morelos, a juvenile male closely resembling the specimen described by Peters. Smith and Grant (*op. cit.*) reported a specimen conforming to the type description of *C. lateritius* from Puerto Vallarta, Jalisco. They restricted the name *lateritius* to the northern population (Puerto Vallarta and "Guadalajara," Jalisco) characterized by the presence of light flecks on top of head, dark spotting on throat, and absence of a light collar on the neck. For the population in the upper Balsas River Basin (represented by specimens from Huajintlán, Morelos, and Izúcar de Matamoros, Puebla, with a light nuchal collar, a light transverse bar on the throat, and no light flecks on top of the head) they resurrected the name *melanocephalus* as a subspecies of *Coniophanes lateritius.*

The type specimen of *C. lateritius* cannot be located (Bailey, *op. cit.*; Cochran, *in litt.*). As stated by Smith and Grant (*op. cit.*) the type may not have come originally from Guadalajara, but instead from the Pacific lowlands of Jalisco. In the absence of a holotype Smith and Taylor (U. S. Nat. Mus., Bull. No. 187, 1945, p. 41) designated the specimen reported by Taylor (*op. cit.*) from Huajintlán, Morelos (EHT-HMS 5198), as the neotype of *C. lateritius* Cope. The subsequent recognition of two races of *C. lateritius* by Smith and Grant and their placement of the specimen from Huajintlán in the race *melanocephalus* invalidates the designation made by Smith and Taylor.

Two specimens of *C. l. lateritius* were recently added to the collections of the University of Michigan Museum of Zoology. The first (UMMZ 114539) was collected August 13, 1956, by Richard E. Etheridge, 6.7 mi. E. of San Blas, Nayarit, elevation 400 feet. This represents the first record from Nayarit and a northern range extension of about 70 miles. The coloration in life (from field notes by William E. Duellman)

1. Contribution No. 42 from the Department of Biology, Wayne State University, Detroit 2, Michigan.

was bright red dorsally, darker middorsally, fading to a reddish brown posteriorly; belly cream; head black. In preservative the colors have faded appreciably. The specimen is an adult male with a body length of 267 mm., tail 129 mm., 148 ventrals, 91 caudals, and 19 scale rows reduced to 17 at ventrals 91 (9+10) and 92 (–9).

The second (UMMZ 118954) collected June 23, 1958, by the author, 12 mi. S. Arteaga, Michoacán, elevation 2900 feet, is the first specimen recorded from that state. The specimen is a male, body length 211 mm., tail 90 mm., 151 ventrals, 91 caudals, and 19 scale rows reduced to 17 at ventrals 98 (–9) and 99 (–9). In life it had an orange dorsum with a bright yellow-cream belly and a black head with pale cream spots (Fig. 1). Preserved, however, it has bleached to an almost straw-colored tan.

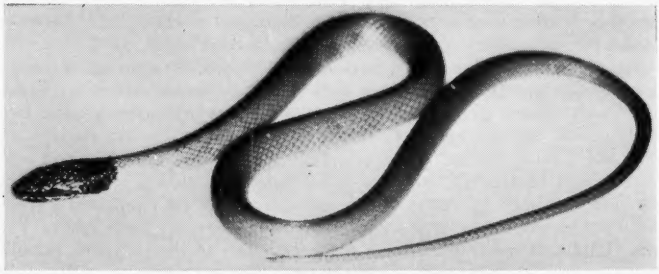

Figure 1. Living specimen of *Coniophanes lateritius lateritius* (now UMMZ 118954) from 12 miles south of Arteaga, Michoacán.

Although the specimen from Arteaga is from a locality between the known ranges of *C. l. lateritius* and *melanocephalus,* it does not display intermediate characteristics; instead it resembles the race *lateritius* in general color pattern but differs from it in the dorsal color, being orange instead of red. Of course, the possibility exists that this specimen represents a distinct race living on the Pacific slopes of the Sierra de Coalcomán. The true status of the population can be ascertained only after the acquisition of additional specimens. The race *lateritius* apparently inhabits mesic environments in the coastal lowlands and foothills from Nayarit southward to Michoacán, whereas *melanocephalus* lives in sub-humid scrub forest at higher elevations in the upper Balsas Basin.

I wish to thank Charles F. Walker for permission to examine the specimens in the University of Michigan Museum of Zoology. Field work in Mexico in 1958 was made possible by a grant from the Graduate School, Wayne State University.

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The Status of Snakes of the Genus *Arrhyton* in Cuba

By CHAPMAN GRANT, HOBART M. SMITH and PASTOR ALAYO DALMAU

Arrhyton is apparently confined to Cuba where it is represented by three distinct species, *vittatum* (Fig. 1), *taeniatum* (Figs. 2, 4), and a long-neglected species, *dolichurum* Werner (Fig. 3). The first two species are reported throughout the island. No subspecies are now recognized.

The snakes of this genus are retiring or of habits so little known that but few specimens are found in collections except for the series of about 40 in the Museo de Historia Natural, "Charles T. Ramsden," Universidad de Oriente, Santiago de Cuba, under the directorship of the junior author. In addition, 4 specimens kindly loaned by Dr. Cochran and six taken by the senior author and one by Lt. Spielman have been studied. We have never seen a gravid specimen.

The revived species is

Arrhyton dolichurum Werner

Cryptodacus redimitus (*nec* Cope), Bocourt, 1883, Miss. Sci. Mexique, livr. 9, pp. 561-562, pl. 35, fig. 8.

Arrhyton redimitus (*nec* Cope), Boulenger, 1894, Cat. Snakes Brit. Mus., vol. 2, pp. 252-253; Stejneger, 1917, Proc. U.S. Nat. Mus., vol. 53: 287-288.

Arrhyton dolichurum Werner, 1909, Mitt. Naturh. Mus. Hamburg, vol. 26, pp. 224-225.

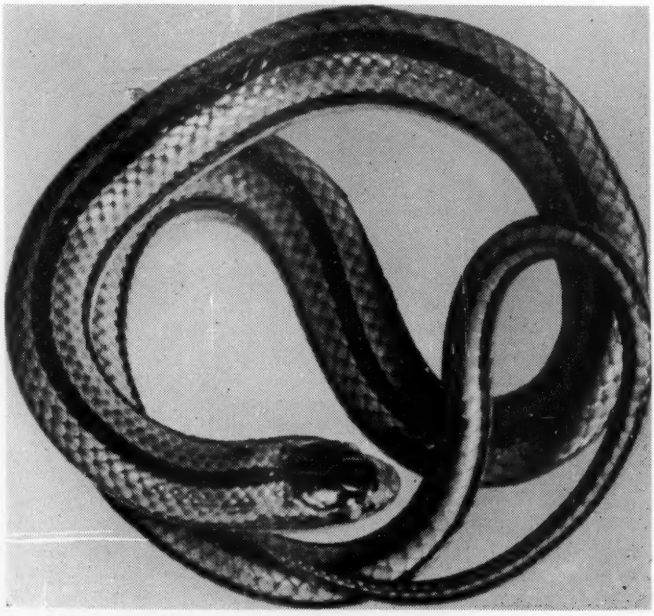

Fig. 1. *Arrhyton vittatum.*

Referred Material. Only three specimens are known to us: (1) the type of *dolichurum,* presumably in the Hamburg Museum; (2) a specimen in the collection of the Museo de Historia Natural "Charles T. Ramsden," Univ. Oriente, Santiago, Cuba, bearing the data "Habana, P. Alayo, XI/1950"; (3) a single specimen from "Cuba" presumably in the Berlin Museum (sent on loan by Peters to Bocourt), reported by Bocourt (see synonymy) erroneously as *"Cryptodacus redimitus."*

Type locality. Obviously the locality datum "Alabama" borne by the type of *dolichurum* is incorrect. Since one of the three known specimens does bear the more precise locality datum "Habana," whence the type with high probability could have come, we hereby restrict the type locality of *Arrhyton dolichurum* Werner to Habana, Cuba. If the holotype proves to be lost, the Oriente specimen would perforce become a neotype, unless other specimens are at the time available from Habana.

Diagnosis. A species of *Arrhyton* differing from both *vittatum* and *taeniatum* in caudal count (114-127 *vs* 79-91 in the known specimens); a loreal present; ventrals 130-141; known maximum s-v length 415 mm.; median dark stripe obsolescent, restricted to one row; lateral dark stripes narrow, on adjacent edges of rows 3 and 4.

Variation. Bocourt (*loc. cit.*) gives 141 ventrals, 120 caudals, prefrontals fused, loreal present, s-v length 300 mm. for his single specimen of *"Cryptodacus redimitus"* which we here regard as a specimen of *doli-*

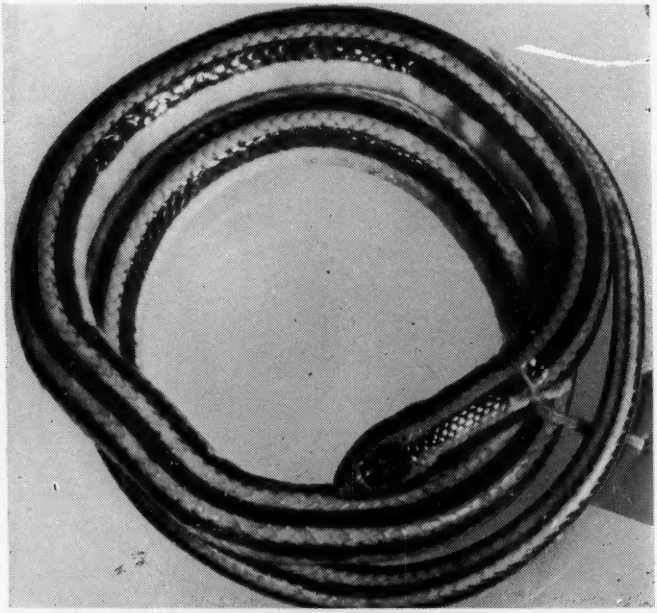

Fig. 2. *Arrhyton taeniatum.*

churum. The colorpattern is described essentially as in the holotype, with narrow stripes not discernible on certain parts of body.

The type of *dolichurum* was said to have 131 ventrals, 114 caudals, a loreal, 2 prefrontals, total length 410 mm., tail 177 mm., pattern as in the preceding.

The Oriente specimen has 130 ventrals, 127 caudals, two prefrontals, loreal present, s-v length 415 mm., dark stripes very narrow (see Fig. 3).

Remarks. No previous reviewers of this genus have had available the type of *redimitus,* which has long been lost. Dr. Doris Cochran of the U.S. National Museum has however found the type in that collection. It has a perfect tail with 83 caudals; the ventrals are 181. The specimen agrees with Cope's original description, and cannot seriously be questioned as constituting the actual type.

In his original description, however, Cope (1862, Proc. Acad. Nat. Sci. Philadelphia, p. 81) neglected to give the ventral and caudal counts-data absolutely essential for identification. Thus, since the type could not be found, one person's guess of its identity was as good as another's, and Bocourt's allocation of the name (*loc. cit.*) with a species having numerous caudals was accepted by all subsequent authors.

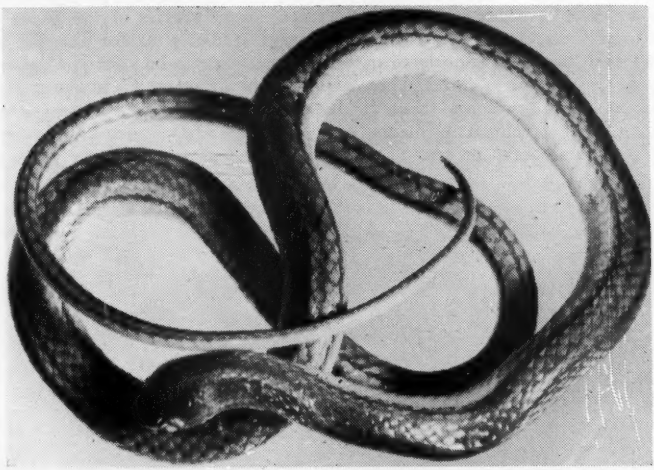

Fig. 3. *Arrhyton dolichurum.*

Rediscovery of the type, however, permits conclusive identification of Cope's *redimitum* as a junior synonym of *taeniatum,* with which it agrees in all particulars, except the presumably variable character of the loreal (absent in *taeniatum,* present in type of *redimita*). This shift of names leaves Bocourt's specimen unallocated and indeed it would so remain had not Werner described a second specimen, and the Oriente collection included a third. So far as we are aware these are the only examples known or reported of the species that must be known by Werner's name *dolichurum.*

Comparisons. The ventrals in *dolichurum* (130-141) in part bridge the gap between the counts of *vittatum* (110-132) and *taeniatum* (174-188), and for this reason for a time we considered the Oriente specimen a hybrid between *vittatum* and *taeniatum.* However, this possibility is remote in view of the much greater number of caudals (114-127) in *dolichurum* as compared with *taeniatum* and *vittatum* collectively (48 [in error?]–98). The Oriente *dolichurum* (415 mm. s-v) exceeds the known size maximum for *vittatum* (330 mm. in 24 specimens), although *taeniatum* reaches an even larger size (556 mm. in 18 specimens). Finally, in both *taeniatum* and *vittatum* the dorsal and dorsolateral dark lines cover, or at least involve, three scale rows; in *dolichurum* the dorsal stripe is limited to one scale row, and the lateral stripes to the narrow adjacent edges of two rows (see Figs. 1-4).

Keys have separated the two species that are commonly compared by the presence of a loreal in *vittatum* vs. its absence in *taeniatum,* and by various interpretations of colorpattern and scutellation that are based on insufficient material. The loreal is actually variable in both species, although it *usually* is present in *vittatum, usually* absent in *taeniatum*; the type of *redimita,* a synonym of *taeniatum,* does for example possess a loreal. The character is of some value but not infallible. The prefrontal however is of much less diagnostic value. In all species of the genus it is usually double, but it frequently is single (fused), as for example in (a) two specimens considered by the junior author to be young of *taeniatum*; (b) in one of three *taeniatum* taken by Grant at Cienfuegos; (c) one of three *taeniatum* taken by him at Banes; (d) in one *taeniatum* taken by Lt. Spielman at Guantánamo, Dec. 1957; (e) in one *dolichurum,* of 3 known specimens; and (f) in the type of *redimita.* Thus the primary

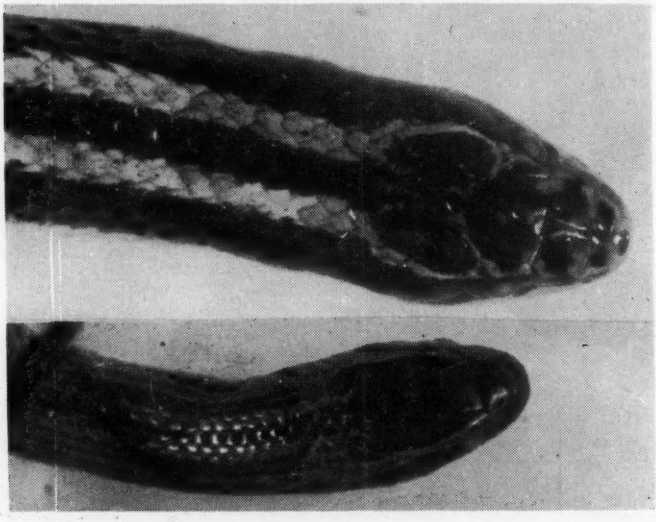

Fig. 4. *Arrhyton taeniatum* (upper), *A. vittatum* (lower).

character assigned by Cope to validate *Colorhogia* (monotypic, type *redimita*) is demonstrably inacceptable. Werner (1929, Zool. Jahrb., 57: 143-144) states that the nasal is undivided in *vittatum* and "*redimitum*"!), half divided in *taeniatum* and *dolichurum*. The character obviously is useless.

The series in the University of Oriente demonstrates that a hiatus of 42 ventrals (Table 1), regardless of sex, separates *taeniatum* from *vittatum*. Twenty-four *vittatum* have ventrals ranging 110-132 (115 in original description); 18 *taeniatum*, 174-188 (count not given in original description). The species also differ in size, *vittatum* reaching 360 mm. s-v, *taeniatum*, 565. The caudals reach 91 in *vittatum*, mean about 76, and 98 in *taeniatum*, mean about 89. In pattern the species differ in width of the light area between middorsal and dorsolateral dark lines; in *vittatum* the light ventral color extends to the edge of 4th row, whereas in *taeniatum* it extends to upper edge of 6th (see Figs.).

TABLE 1. Scale counts on *Arrhyton*

	Caudals	Ventrals	s-v
taeniatum (18)	79- 89- 98	174-180-188	200-420-556
vittatum (24)	48- 76- 91	110-122-132	151-260-360
dolichurum (3)	114-120-127	130-134-141	233-316-415

Several species have been described on minor variations, but are now in synonymy. *A. vittatum* (Gundlach & Peters) (Monatsb. Akad. Wiss. Berlin, 1861: 1002) includes *bivittatum* Cope (Proc. Acad. Nat. Sci. Phila., 1862: 82, type USNM 5784). *A. taeniatum* includes *Colorhogia redimita* Cope (see preceding account), and *A. fulvum* Cope (Proc. Acad. Nat. Sci. Phila., 1862: 82, type USNM 12421). Stejneger (*op. cit.*) has already thoroughly substantiated this synonymy, except for *redimita*. Like Stejneger, we reject Andersson's (1901, Bih. Svenska Vet. Akad. Handl., vol. 27, sect. 4, no. 5: 15-17, pl. 1, figs. 5-7) *Arrhyton quenseli* from unknown locality as a member of the genus *Arrhyton*. It has 2-2 temporals, 153-157 ventrals, 63-67 caudals, two rear maxillary teeth enlarged (instead of one as in *Arrhyton*). We are unable at this time to place the name with any other known species, but the characters cited clearly eliminate *Arrhyton* from consideration.

Barbour and Ramsden (1919, Mem. Mus. Comp. Zool., 47: pl. 15, fig. 13) as well as Stejneger (*op. cit.*) depict USNM 5784, the type of *bivittatum*, with the caption ". . . pattern at about middle of body." The figure shows normal dorsolateral stripes of *vittatum*, but no trace of a middorsal dark stripe which is present in every specimen of the genus ever seen by the authors. A letter to Dr. Cochran requesting a check of this specimen received an immediate reply that "USNM 5784 is very old . . ., but it still shows traces of a fairly wide dorsal stripe about 3 scales wide . . ."

We are deeply indebted to Dr. Doris Cochran for lavish assistance with types and other specimens in the U.S. National Museum.

ESCONDIDO, CAL., UNIV. ILL., URBANA and
UNIV. de ORIENTE, SANTIAGO de CUBA

Notes on the Maxillary Dentition of Some Frogs of the Genera *Eleutherodactylus* and *Leptodactylus*

By COLEMAN J. GOIN

Since the data presented recently (Goin, C. J., Herpetologica, Vol. 14, 117-121, 1958) on the variation in maxillary dentition in some hylid frogs seems to have proven useful, I have extended these studies to some species of the complex genus *Eleutherodactylus,* as well as to a few specimens of *Leptodactylus.*

The technique employed for cleaning and counting the teeth was the same as that used in the Hylidae. The count for each specimen was made on the left maxillary bone and for this purpose it was necessary to remove and clean the bone. The fleshy skin was separated from the left upper jaw by running a sharp needle under the lip. With fine pointed scissors the quadratojugal was then cut posterior to the maxillary bone and a similar cut was made on the premaxillary bone anterior to the maxillary. With the aid of fine forceps and scissors the maxillary bone was then worked loose and cut from its articulations with the pterygoid, palatine, and nasal bone, and thus removed from the head.

After excising, the jaw bone was washed in a weak solution of sodium hypochlorite (Clorox or a similar commercial bleach used full strength is satisfactory) to remove excess flesh, rinsed in clear water, then rerinsed and soaked in a second wash water to remove the bleach solution. The time necessary for soaking in water ranges from 20 minutes to several hours, depending on the size of the jaw bone. After the jaws were cleaned and dried, the teeth were counted and the data tabulated.

Analysis of the data presented in Table 1 indicates that the number of maxillary teeth may prove to be a useful character in defining and diagnosing species of *Eleutherodactylus* and *Leptodactylus.* It may be that dentition will also prove helpful in defining species groups. In the Jamaican species with which I am best acquainted, for example, those in the *cundalli* group seems to have a higher number of teeth than do those in the *gossei* group. Thus in the former group we find the average number of teeth on the maxillary bone is: *lynni,* 89; *cavernicola,* 75; *grabhami,* 73; and *cundalli,* 72; whereas in the *gossei* group, the average is: *gossei,* 59; *alticola,* 50; *andrews,* 52; *nubicola,* 59; and only in the large *pantoni,* 70, do we find the average number of maxillary teeth approaching those of the *cundalli* stock.

In am indebted to the Graduate School of the University of Florida for making available the services of a graduate assistant. I am particularly indebted to the assistant, Mr. Ronald Baxter, both for his care and diligence in excising the jaws and making the counts and for his thoughtful analysis of the data. Dr. Doris M. Cochran, United States National Museum, Mr. Neil D. Richmond, Carnegie Museum, and Dr. William Riemer, of the University of Florida, made specimens available to me for study—to them I owe my thanks. Transportation to Washington to select specimens for study was made possible by a grant, G-5628, from the National Science Foundation.

Table 1 lists the species, the localities from which they came, the number of specimens examined and the range, mean and standard deviation for the number of teeth of each species.

TABLE 1

Eleutherodactylus	*No.*	*Range*	*Mean*	*Stand. Dev.*
abbotti, Haiti, Dominican Republic	5	60-67	64.20	2.48
alfredi alfredi, Mexico	14	58-73	65.36	4.53
alfredi conspicuus, Guatemala	2	66-72	69.00	3.00
alticola, Jamaica	18	45-60	51.80	4.10
andrewsi, Jamaica	4	47-58	52.20	4.82
atkinsi, Cuba	1		69.00	
audanti, Haiti	8	47-77	57.25	8.61
auriculatoides, Dominican Republic	9	58-78	66.89	6.98
auriculatus, Puerto Rico	10	60-82	68.60	6.55
avocalis, Mexico	5	50-58	53.80	2.99
bakeri, Haiti	2	55-58	56.50	1.50
bicumulus, Venezuela	11	57-83	64.30	7.14
binotatus, Brazil	4	54-77	64.75	8.64
biporcatus, Nicaragua	5	46-58	51.80	4.96
brevipalmatus, Cuba	3	55-77	63.00	9.93
brocchi, Guatemala	1		42.00	
bufoniformis, Panama Canal Zone	11	60-80	68.40	6.24
calcitrans, Mexico	4	42-51	48.00	3.54
cavernicola, Jamaica	6	68-87	75.67	5.91
cerasinus, Panama Canal Zone	1		65.00	
cooki, Puerto Rico	1		89.00	
cramptoni, Puerto Rico	1		65.00	
cundalli cundalli, Jamaica	12	59-94	72.08	9.31
c. lynni, Jamaica	9	74-108	89.11	12.40
cuneatus, Cuba	6	64-77	70.50	5.06
dimidiatus, Cuba	2	69-70	69.50	.50
fitzingeri, Panama Canal Zone	3	61-82	69.00	9.28
flavescens, Dominican Republic	5	61-86	70.80	9.11
fleischmanni, Costa Rica	3	45-47	46.00	.82
gaigei, Costa Rica	1		80.00	
golmeri, Venezuela	2	74-80	77.00	3.00
gossei, Jamaica	9	52-66	59.00	4.64
grabhami, Jamaica	7	67-81	73.14	5.00
guentheri, Brazil	11	57-72	63.82	5.02
gundlachi, Cuba	1		70.00	
inoptatus, Dominican Republic	9	71-85	75.33	4.50
jamaicensis, Jamaica	10	47-89	67.40	11.94
jugans, Haiti	2	46-48	47.00	1.00
karlschmidti, Puerto Rico	1		81.00	
lanciformis, Panama	2	75-84	79.50	4.50
latidiscus, Panama	2	71-86	78.50	7.50
latrans, Texas	6	57-62	59.70	2.13
lentus, Virgin Islands	6	57-76	65.17	6.79

longirostris, Panama Canal Zone	4	71-81	73.20	4.28
luteolus s.s., Jamaica	2	65-69	67.00	2.83
martinicensis, Barbados	2	83-89	86.00	3.00
martinicensis, Jamaica	12	67-91	78.33	7.88
matudai, Mexico	3	37-41	38.33	1.89
mexicanus, Mexico	5	41-49	44.20	2.79
molinoi, Panama	9	54-75	66.20	6.15
monensis, Mona Island	2	52-69	60.50	8.50
nasutus, Brazil	3	58-67	61.33	4.03
natator, Mexico	6	60-74	67.50	4.89
nubicola, Jamaica	13	54-64	59.38	3.27
ockendeni, Panama Canal Zone	4	67-78	72.00	3.92
orcutti, Jamaica	10	50-62	57.80	4.04
pantoni, Jamaica	11	63-77	70.91	4.23
parvus, Brazil	2	50-61	55.50	5.50
polyptychus, Panama	3	43-48	45.67	2.06
poolei, Haiti	2	72-74	73.00	1.00
portoricensis, Puerto Rico	3	70-76	73.00	2.45
punctariolus, Panama	1		48.00	
richmondi, Puerto Rico	2	89-94	91.50	2.50
ricordi planirostris, Fla.: Alachua Co.	47	34-61	43.91	7.16
ridens, Costa Rica	2	54-73	63.50	9.50
rugulosus, Mexico	18	43-79	57.77	11.29
rugosus, Costa Rica	3	33-39	36.33	2.49
ruthae, Dominican Republic	9	75-87	79.89	3.14
s. schmidti, Haiti	5	45-64	57.00	6.66
schmidti limbensis, Haiti	8	63-85	76.50	7.19
sierramastrae, Cuba	4	65-74	68.25	3.49
spatulatus, Mexico	2	64-69	66.50	2.50
urichi, Trinidad	5	47-62	55.80	6.48
weinlandi, Dominican Republic	6	50-66	55.17	5.27
wetmorei, Haiti	3	90-111	98.00	9.27
Leptodactylus				
bufonius, Argentina	1		61.00	
dengleri, Costa Rica	2	71-74	72.50	1.50
hylaedactylus, Colombia	5	51-59	54.50	3.07
hypo, Argentina	1		51.00	
ingincus, Argentina	1		62.00	
intermedius, Colombia	3	55-79	69.00	10.20
labialis, Mexico	3	43-59	50.33	6.60
melanonotus, Mexico	5	43-49	45.60	2.15
ocellatus, Argentina	1		70.00	
pentadactylus, Panama Canal Zone	1		68.00	
petersi, Trinidad	2	57-58	57.50	.50
prognathus, Argentina	1		47.00	
typhonius, Trinidad	1		61.00	

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The Tongue in Urodela

By WILLIAM A. HILTON

The tongue differs widely in the tailed Amphibia; in *Necturus, Proteus, Siren, Pseudobranchus, Amphiuma* and larvae of all forms it is only slightly separated from the floor of the mouth at the tip. In *Cryptobranchus* and *Amphiuma* it is broad, flat and strongly enforced with dense connective tissue. In all other forms it is better defined, usually rounded or oblong, fleshy and glandular, always free laterally and in many cases free all the way around, being a disc at the end of the pedicel of the hyobranchial apparatus.

In Hynobiidae and Ambystomidae it is not free at the tip, with fine parallel ridges running from the center of the back part forward, sometimes from a pit or depressed groove. In Salamandridae it is frequently small and smooth, more free from attachments than in the last two families mentioned.

In Plethodontidae it is usually nearly circular in outline and free all about its edges; or larger, more elongate and fastened to some degree in front. It may be quite smooth with, in some cases, a depression in or near the center. Sometimes it is quite large and elongate with delicate parallel ridges or grooves.

It is especially small and free in *Hydromantes, Eurycea, Hemidactylium, Manculus* and *Pseudotriton.*

In larvae the ceratohyals are at the tip end of the basibranchial, a little back from the very tip of the tongue. In adults the copula or first basibranchial extends into the tongue substance. Lateral rods from the central copula may extend out almost at right angles or may support the tongue by extension at different angles either more or less fixed or movable with changes in the tongue activities. They also serve as muscular attachments. In some Plethodontidae with free tongues, such as the genera *Gyrinophilus, Pseudotriton, Manculus, Eurycea* and *Hemidactylium,* at the ends of the copula is a small, separate cartilage, the lingual cartilage, to which delicate muscle fibers are attached.

The muscles connected with the tongue or involved in its movements are as follows:

M. Genioglossus (Fig. 1). This is not found in all, but is especially well developed in *Cryptobranchus, Ambystoma, Rhyacotriton* and in a peculiar manner in *Batrachoseps.* It usually fills the angle between the two halves of the lower jaw where the two sides meet in front. It is often of median and lateral fibers, inserted in the forward part of the tongue. In *Batrachoseps,* the muscle runs from the base of the mandible on each side, forward to near the end of the mandible to be inserted into the tongue.

In general this muscle is near the surface, but in some cases it may be covered with fascia and other muscle fibers. It is supplied by branches of the so-called N. hypoglossus.

If the tongue is at rest, contraction of this muscle tends to draw the tongue towards the front and arch its upper surface. If the tongue is fully extended, contractions would help retract it towards the mouth. It serves also to compress the glandular region to form a mucous coating which

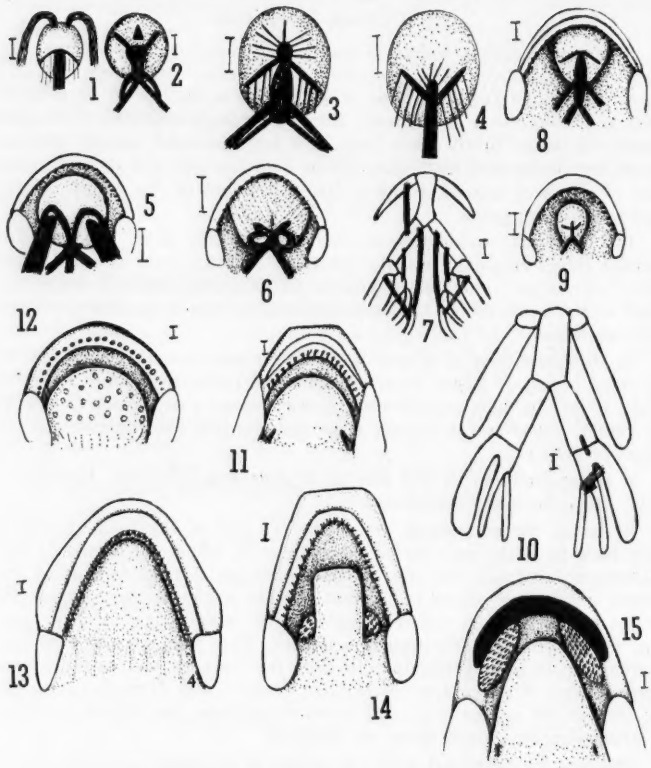

Fig. 1. Scale equals one mm in every case.

1-4. Tongues of salamanders showing the end of the hyobranchial apparatus and some muscle fibers.

1. *Batrachoseps* with genioglossus muscles at the top. 2. *Hemidactylium* with lingual cartilage. 3. *Leurognathus*. 4. *Cynops*. 5, 6, 8 and 9. Lower jaws showing hyobranchial apparatus and tongue. 5. *Salamandrella* (Hynobidae). 6. *Ambystoma*. 8. *Diemictylus*. 9. *Plethodon*. 7. Hyobranchial apparatus of larval Ambystoma showing position of internal muscles. 10. Hyobranchial apparatus of young *Siren* with some muscles. 11. Floor of the mouth and tongue of *Necturus*. 12. Floor of the mouth of young *Cryptobranchus*. 13. The same of *Amphiuma*. 14. The same of *Proteus*. 15. The same of *Siren*.

aids in insect capture.

M. Suprapendicularis. This is found in adult Plethodontidae, attached to the anterior ends of the ceratohyals, connecting them as a band under the border of the tongue, dorsal to the tongue stalk. It is especially well developed in free-tongued forms but is also found in most other land forms. It is present in *Desmognathus* and *Leurognathus,* but is not very important and is poorly developed in *Stereochilus* and *Typhlotriton.* In *Gyrinophilus, Manculus, Eurycea* and *Pseudotriton* it is not entirely distinct from muscles of the pharyngeal region. It is well developed in *Plethodon, Aneides, Ensatina, Bolitoglossa, Hydromantes* and *Batrachoseps.* It may aid in holding the tongue firmly and help in extending it.

M. Hypoglossus. This is a very small muscle in the tongue of several of the family Plethodontidae, but also in some other land forms. Its fibers pass from the dorsal side of the anterior end of the copular backwards on either side of the cartilage to be inserted into the body of the tongue and to some degree into the hyobranchial cartilages. It is supplied by the so-called hypoglossal nerve. It may compress the tongue glands and pull the hyobranchial apparatus slightly backwards.

M. Sternohyoideus (*M. Rectus cervicus superficialis*). This arises from the region of the ventral thorax and is inserted in several places, differing a little in different groups. In general it runs forward to end: (a) on the hyobranchium where it joins basale or copula; (b) on the tendon or fascia of the abdominohyoideus; (c) on the os triangulare when this is present, or in this region. It is supplied by branches of the first three spinal nerves. It helps to retract the tongue.

M. Abdominohyoideus (*Rectus cervicus profundus*). This is the forward extension of the rectus abdominus. Part of it is inserted into the dorsal side of the apex of the copula in or near the base of the tongue. It is supplied by branches of the first three spinal nerves. It retracts the tongue.

M. Subhyoideus. This arises from the posterior end of the ceratohyal, inclosing it in a hollow cylinder. It is inserted in the dorsal side of the aponeurosis of the M. intermandibularis posterior. It is supplied by branches of the 7th cranial nerve. By its contraction the tongue is elevated.

M. Subarcualis rectus I (*M. ceratohyoideus*). This arises from the dorsal side of the posterior end of the first ceratobranchial cartilage, forming a complete sheath about it. The fibers are more or less parallel with the cartilage and are inserted into the ventro-anterior border of the anterior end of the ceratohyal. It is supplied by branches of the 9th and 10th cranial nerves. Its contraction advances the hyobranchial region, especially the copula and the tongue.

Experiments by Drüner (1901) explain the actions of these muscles somewhat as follows:

Contraction of the subhyoideus advances the ceratohyal anterodorsally. When the jaws are opened wide as at the snapping at prey causing the upper surface of the tongue to extend forward, the subhyoideus brings the surface of the tongue level with the snout. The ceratohyal is held in this position by the subhyoideus and its anterior end becomes a fixed point for the ceratohyoideus internus which by rapid contractions forces the branchial arches, copula and tongue forward. This muscle also pulls the posterior end of the ceratobranchial ventrally causing the arches to twist

about the copula forcing it still farther forward.

The result of all these actions is to project the tongue from the mouth to secure the prey, sometimes at quite a distance from the mouth, especially in *Hydromantes* and *Eurycea*. The tongue with food is brought back into the mouth by action of the hypoglossus and abdominohyoideus. When the mouth is closed the subhyoideus and ceratohyoideus force the tongue against the vomerine teeth helping to force the food back so it may be swallowed by action of the pharyngeal muscles.

REFERENCES

Drüner, L. 1901-3. Studien zur Anatomie der Zungenbein, Kehlkopfmuskulatur der Urodelen. I Theil., Zool. Jahrb. Abt. f. Anat., 15: 435-622; II Theil, *ibid.*, 17: 361-690.

1903. Ueber die Muskulatur der Visceralbogen der Urodelen. Vehr. Anot. Ges., 17: 142-4; *ibid.*, Anat. Anz., 23: 545-571.

Eaton, T. H., Jr. 1936. Myology of Salamanders. Jour. Morph., 60 (2): 31-72.

Francis, E. T. B. 1934. The anatomy of the salamander. Oxford.

Hilton, W. A. 1957. Head muscles of salamanders. Bull. So. Calif. Acad. Sci., 56: 1-13.

Piatt, J. 1935. A comparative study of the hyobranchial apparatus and the throat musculature in Plethodontidae. Jour. Morph., 55 (2): 213-251.

Smith, L. 1920. The hyobranchial apparatus of Spelerpes bislineata. Jour. Morph., 53: 527-551.

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TERRITORIALITY IN *RANA CLAMITANS*.—In Mississippi *Rana clamitans* is more of a creek-river frog than *Rana pipiens*, although *clamitans* is common in ponds and roadside rain pools during the breeding season. I have found *clamitans* very common along spring branches and creeks and it is present in large numbers in late fall along the larger streams such as the Pearl and Leaf Rivers.

The communal habits of *clamitans* in Mississippi are different from those of *Rana pipiens sphenocephala*. The males of *clamitans* seem to have territories along the creeks that they guard or defend from other males. I have observed males standing upright on their hind legs in a wrestling position, chest to chest. They would topple over and continue to paw each other in an attempt to get upright. This activity would continue until one or the other swam away or hopped off into the grass.

Large marked males were observed sitting in a favorite spot along a creek bank night after night. I marked the frogs by clipping the toes of the back feet. In one experiment the toes of 15 were clipped to see how far they would travel in a given time. Most of them remained within a few yards along the stream bank. It was common to find two large males occupying opposite banks of the wider streams.

The females seem to range through a much greater area than the males, passing from one territory to another. No aggressiveness was observed between males and females or between females.—*William E. Brode, Gulf Coast Research Laboratory, Ocean Springs, Mississippi.*

Distributional and Biological Notes on the Nebraskka Herpetofauna

By FREDERICK R. GEHLBACH and BRUCE B. COLLETTE

Since a general study by Hudson (1942, Neb. Cons. Bull. 24: 1-146) little has been added to knowledge of the distribution and life histories of amphibians and reptiles in Nebraska. A Cornell University field party working in southern and western portions of the state in June 1956 and 1957 discovered the many county records presented herein, all of which are new except those for *Thamnophis sirtalis*. For the most part these localities represent range extension along river valleys in the relatively flat, unmodified high plains. Such sheltered routes of dispersal have been utilized by many vertebrate groups (Dice, 1943, Univ. Mich. Press: v-78).

We are especially grateful for the use of field notes supplied by David A. West, Fred C. Sibley and David B. Wingate. We also wish to thank Howard E. Evans for aid in identification of the insects and William J. Hamilton, Jr. for advice on food habits analysis. Numbers in parentheses refer to catalog numbers in the Cornell University Herpetological Collection. All measurements are in millimeters.

Bufo woodhousei woodhousei Girard. Colfax Co., 2.5 mi. E.S.E. Schuyler, 1300 ft., (6255, 6324); Dawson Co., 2 mi. S.E. Gothenburg, 2500 ft., (6326); Deuel Co., 8 mi. S.W. Big Springs, 3500 ft., (6254); Hall Co., 7 mi. S.S.W. Grand Island, 1900 ft., (6322); Lincoln Co., 1 mi. S. Sutherland, 2950 ft., (6325); McPherson Co., 18 mi. W. Tryon, 3500 ft., (6327); Washington Co., 4 mi. S.E. Blair, 1000 ft., (6323). Adult females from Colfax and McPherson counties contained many eggs. Although all anurans were collected June 6-26, 1956 and 1957, these toads were the only ones observed in breeding condition. The possibility that breeding *woodhousei* feed either underwater or at the surface on aquatic insect larvae is indicated by the presence of large numbers of dytiscid, hydrophilid and stratiomyid larvae in the stomachs (Table 1).

TABLE 1. Stomach Contents of 13 *Bufo woodhousei* from Nebraska

Food	Frequency %	Volume %	Food	Frequency %	Volume %
ARACHNIDA	15.4	1.9	DIPTERA		
COLEOPTERA	100.0	63.5	Stratiomyiidae	15.4	1.5
Carabidae	92.3	37.7	HEMIPTERA		
Cicindelidae	23.1	2.7	Cicadellidae	15.4	1.5
Chrysomelidae	7.7	0.8	HYMENOPTERA	46.2	17.8
Curculionidae	23.1	5.4	Formicidae	38.5	17.0
Dytiscidae	7.7	1.9	Tiphiidae	7.7	0.8
Elateridae	7.7	0.8	LEPIDOPTERA	23.1	10.0
Hydrophilidae	7.7	0.8	Noctuidae	15.4	6.9
Scarabaeidae	30.8	8.5	Pyralididae	7.7	3.1
			ORTHOPTERA		
Staphylinidae	7.7	2.7	Acrididae	7.7	3.1
Silphidae	7.7	2.3	INORGANIC	15.4	0.7

Acris crepitans blanchardi Harper. Colfax Co., 2.5 mi. E.S.E. Schuyler, 1300 ft., (6257); Dawson Co., 2 mi. S.E. Gothenburg, 2500 ft., (6320). Of eight specimens, two contained carabids, two had pyralid larvae and one each contained mirids and small spiders.

Pseudacris triseriata ssp. Wied. Lincoln Co., 1 mi. S. Sutherland, 2950 ft., (6321).

Rana catesbeiana Shaw. Dawson Co., 2 mi. S.E. Gothenburg, 2500 ft., (6317).

Rana pipiens Schreber. Colfax Co., 2.5 mi. E.S.E. Schuyler, 1300 ft., (6256); Dawson Co., 2 mi. S.E. Gothenburg, 2500 ft., (6319); Lincoln Co., 1 mi. S. Sutherland, 2950 ft., (6318). In six specimens one contained a curculionid and another a tenebrionid beetle; two had adult formicids, one an apid, another a noctuid larva and still another had an adult libellulid; five contained a spider each.

Trionyx spinifer hartwegi Conant and Goin. Dawson Co., 2 mi. S.E. Gothenburg, 2500 ft., (5649); Lincoln Co., 1 mi. S. Sutherland, 2950 ft., (5650). The Dawson County specimens are 25 eggs averaging 24x 25.2 taken from a nest dug 15 feet from the Platte River on a sandbank. The neck of the nest was three inches across, the hole six inches deep and five inches wide at the bottom. Temperature in the nest was 80° F. at 5:30 p.m., June 19, 1957; ambient temperature was 82° F. Fresh *Trionyx* tracks and several other nests were seen on the sandbank.

Holbrookia maculata maculata Girard. Deuel Co., 8 mi. S.W. Big Springs, 3500 ft., (5483); Phelps Co., 3 mi. S.E. Elm Creek, 2300 ft., (5482). Females collected June 18, 1956, measured 45.5, 55.0, and 55.5 s-v (snout-vent length); and contained three, six, and five eggs respectively. These averaged 7-10 for the smallest and 6.5x13 for the largest female. The stomach of the smallest contained a tettigoniid grasshopper.

Cnemidophorus sexlineatus sexlineatus Linne. Deuel Co., 8 mi. S.W. Big Springs, 3500 ft., (5485); Lincoln Co., 1 mi. S.E. Sutherland, 2950 ft., (5486, 5638). A female captured June 23, 1957, was 68.5 s-v; and contained four eggs averaging 8x13.5.

Eumeces multivirgatus Hallowell. McPherson Co., 16 mi. W. Tryon, 3500 ft., (5637). An adult male, 53.5 s-v, taken June 26, 1957, had enlarged testes and some red on the head; two females collected on the same date contained numerous small eggs, 1.8 or less in diameter. These and four blue-tailed juveniles were all taken from beneath dried cow dung on a sandy hill characterized by yucca; none were found beneath fallen plants. Colorpatterns of all specimens were typical, there being no indication of polychromatism in the series.

Eumeces septentrionalis septentrionalis Baird. Colfax Co., 2.5 mi. E.S.E. Schuyler, 1300 ft., (5481, 5634); Hall Co., 7 mi. S.S.W. Grand Island, 1900 ft., (5635); Polk Co., 3 mi. S.S.W. Silver Creek, 1550 ft., (5636). A female taken June 8, 1956, was 84.5 s-v and contained 18 eggs averaging 8.5x11, a significantly larger clutch than previously reported (Breckenridge, 1943, Am. Midl. Nat. 29 (3): 591-606); (Clarke, 1955, Herpetologica 11 (3): 161-164). Another female, 73.0, had 11 eggs averaging 7.5x9. All males had red, swollen heads and enlarged testes; they were collected with females under rotten logs in open grass bordering the Platte River.

Natrix sipedon sipedon Linne. Lincoln Co., 1 mi. S. Sutherland, 2950 ft., (5647). An adult male collected in an irrigation ditch disgorged a large cyprinid fish.

Thamnophis radix haydeni Kennicott. Hall Co., 7 mi. S.S.W. Grand Island, 1900 ft., (5480, 5643); McPherson Co., 18 mi., W. Tryon, 3500 ft., (5644); Phelps Co., 3 mi. S.E. Elm Creek, 2300 ft., (5646); Polk Co., 3 mi. S.S.W. Silver Creek, 1550 ft., (5645). Two specimens 521 and 616.5 t-l (total length) contained 17 eggs (averaging 9.5x16) and 21 (averaging 4.5x9) respectively. These were collected June 13 and 26, 1957. One male regurgitated an earthworm, and another was taken as it actively pursued transforming *Bufo woodhousei* on the open sandy shore of a pond.

Thamnophis sirtalis parietalis Say. Colfax Co., 2.5 mi. E.S.E. Schuyler, 1300 ft., (5641, 5642); Lincoln Co., 1 mi. S. Sutherland, 2950 ft., (5640). Females captured June 7-9, 1957, in Colfax County contained 37 eggs (averaging 12.5 in diameter) and 16 (averaging 11.5 in diameter) respectively. The snakes measured 991 and 618.5 t-l. Two taken June 23-25, 1957, in Lincoln County were 789.5 and 836 t-l and each had 14 eggs averaging 22x8 and 20x9.5 respectively. Several of these garter snakes were found on islands in the middle of the Platte River; these had *Bufo woodhousei* in their stomachs.

Heterodon nasicus nasicus Baird and Girard. McPherson Co., 16 mi. W. Tryon, 3500 ft., (5648). This juvenile male contained five reptile eggs, possibly those of *Eumeces multivirgatus* since several of the skinks were taken in the immediate vicinity.

Elaphe obsoleta obsoleta Say. Washington Co., 4 mi. S.E. Blair, 1000 ft., (5649). A female taken June 4, 1957, measured 1445 t-l and contained nine eggs averaging 12.5x33.

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CALIFORNIA LOCALITY RECORDS FOR *ARIZONA ELEGANS* AND *EUMECES GILBERTI*.—A male Glossy Snake, *Arizona elegans occidentalis,* was collected near some oak trees in rolling, savanna type country by Mr. William Leverich, May 27, 1956 on a ranch 2 miles east of Creston, San Luis Obispo Co., Cal. This is the first record for the county and represents a range extension of approximately 44 miles nearly due south from Coalinga, Kings Co., and 49 miles west northwest from McKittrick, Kern Co., the nearest localities reported by Klauber (1946, *Trans. San Diego Soc. Nat. Hist.,* Vol. 10, p. 378). More significant, it is the second record from west of the inner coast range of central California. Crawford (1958, *Herpetologica,* Vol. 14, p. 183) reported the first from 6 miles east of Mt. Hamilton, Santa Clara Co. All other central California records are from the San Joaquin Valley. Snout-vent length 700 mm.; tail 110 mm.; scale rows at mid body 27; ventrals 211; caudals 53; supralabials 8; infralabials 14. It agrees in color and pattern with the description of *occidentalis* (Klauber, *op. cit.,* p. 372-376) except that it lacks brown spots on the first and on the last few infralabials.

On May 10, 1958 Mr. C. I. Haydock collected a *Eumeces gilberti* 8

miles east of Simmler and 1 mile south of the county line, along State Highway 178, in San Luis Obispo Co. It was collected in accumulated debris under cottonwood and willow trees growing along Sandiego Creek, which was dry. Rodgers and Fitch (1947, *Univ. Cal. Pub. Zoo.*, Vol. 48, p. 202) reported a previous specimen from Polonio Pass, 5½ miles east of Cholame, on the Kern-San Luis Obispo Co. line, so that this specimen is perhaps the first taken within the county. It is a male, testes 10 mm. long, snout-vent length 89 mm., total length 225 mm. In life the head was distinctly orange and two faint, pale dorso-lateral lines were visible. It represents the intergrade population between *E. g. cancellosus* to the north and *rubricaudatus* to the south and east.

Both specimens are in the collection of the California State Polytechnic College Museum of Natural History.—*Aryan I. Roest, California State Polytechnic College, San Luis Obispo, Cal.*

NOTES ON THE HABITS OF SOME PLETHODONTID SALAMANDERS.—The method used by crocodilians to dismember their prey by rapid, longitudinal rotation of the body is well known. Not so well known is the fact that lizards and large salamanders also employ this mode of attack as noted by Oliver (*The Natural History of North American Reptiles and Amphibians, 1955.*) This report cites two other instances of this phenomenon in herpetozoa.

Experimental work on a case of supposed warning coloration and mimicry in plethodontid salamanders required collecting and keeping large numbers of *Plethodon jordani jordani* and various species of *Desmognathus*. It also required observation of these animals when attacked by predators under laboratory conditions.

Some specimens of *Plethodon j. jordani* were kept for more than a year. During this period they were fed on *Drosophila* and *Lumbricus*. When a salamander attacked a large earthworm, it would seize the prey firmly in the jaws and rapidly rotate the body until the earthworm broke. It would then swallow the fragment and attack the remainder. Thus a salamander could consume an earthworm considerably longer than itself. In the humid forests of the Smoky Mountains in which *jordani* lives, earthworms are abundant and probably form a substantial part of its diet.

In the experimental work of having the salamander attacked by various predators it was noticed that when specimens of *Desmognathus* were attacked they would often rotate the body in a manner similar to that described above. If the predator had seized the animal by the tail, the result was loss of the tail and presumably, under natural conditions, escape of the salamander. When under threat of attack, these animals often twitch the tip of the tail, drawing attention to it and thus enhancing the possibilities of such behavior.

The presence of this phenomenon in these additional forms indicates that it may be a general means by which animals of this specific body type can overcome disproportionately large prey and in special instances implement and assist a primitive autotomy. Thus the basic mechanism can be used for both offensive and defensive advantage.—*James E. Huheey, Museum of Natural History and Dept. of Zoology, University of Illinois, Urbana.*

A New Subspecies of *Phyllorhynchus browni* from Sinaloa

By FREDERICK A. SHANNON and FRANCES L. HUMPHREY

At 9:05, on the evening of July 16, 1957, a large female *Phyllorhynchus* was collected on the highway, 45.7 mi. S. Culiacán, Sinaloa, Mexico. The road temperature at that time was 31.0° C.; the anal temperature of the snake was 31.2° C.; 1 centimeter above the road, 29.6° C.; air, 29.2° C. The relative humidity, as measured by a Bacharach sling psychrometer, was 100%. No rainfall was recorded for that evening, and there had probably been none during the preceding day.

A second individual was found D.O.R. on July 15, 1958, 55 to 60 mi. N. Mazatlán, Sinaloa. The snake was discovered in rocks, just to the right of the Pacific Coast Highway, at 4:00 a.m., following scattered showers most of the evening.

These snakes, representing a southern range extension of nearly 200 and 245 miles for *Phyllorhynchus,* are different from those of any other known population of the genus. They are closely related to *P. b. fortitus* and are here considered as a new subspecies of *browni.*

Phyllorhynchus browni klauberi, new subsp.*

Holotype. FAS No. 12367, a female from 45.7 mi. S. Culiacán, Sinaloa, collected on July 16, 1957, by F. L. Humphrey and F. A. Shannon. Fig. 1.

Paratype. FAS No. 13523, a male from 55-60 mi. N. Mazatlán, Sinaloa, collected on July 15, 1958, by F. A. Shannon and F. L. Humphrey.

Diagnosis. Most closely related to *Phyllorhynchus browni fortitus* in that both populations have dorsal bands more than two times wider than the interspaces. These bands in the other two known subspecies are less than twice the width of the interspaces. In addition, the lateral borders of the dorsal blotches in both *fortitus* and *klauberi* reach the first or second scale rows, as contrasted to the narrower blotches of *browni* and *lucidus.*

P. b. klauberi differs from *fortitus* in generally greater total pigmentation; in a tendency for the pigment in the interspaces to "clump" into irregular macules, rather than to be evenly dispersed over the surface of the scale; in posterior extension of the interorbital band to form a distinct, dark parietal spot, similar to that of *P. browni lucidus.* The dorsal blotches of *klauberi* are not irregularly bordered laterally with darker pigmentation as are those of *fortitus,* although occasional scales may show darker pigmentation. The frontal of *klauberi* is longer than that of *fortitus* with a width-length ratio less than 0.85 for *klauberi* and greater than 0.85 for *fortitus* (*cf.* discussion). The rostral plate of *fortitus* is comparatively wider than that of *klauberi* and is more truncate, with a lateral flare and concave coving of the nasal border that is absent in *klauberi.* It is

* Named for Dr. Laurence M. Klauber in recognition of his excellent work on the genus *Phyllorhynchus.*

probably safe to state that *klauberi* is a larger snake than *fortitus,* although individuals of both subspecies are apparently larger than those of *P. b. browni* and *P. b. lucidus.*

Description of the holotype. The snake has a total length of 485 mm. and a tail length of 38 mm., with a %-tail-of-total-length of 7.83.

The rostral is much longer than wide, curving back over the snout to widely separate the internasals and contact the prefrontals. Rostral concave ventrally, thick, sides weakly grooved; prefrontals rather small but considerably larger than triangular internasals. Frontal large, crudely hexagonal, broadly contacting wedge-shaped supraoculars laterally and penetrating between parietals posteriorly for about 1/5th the length of the parietals; supraoculars, 1-1; parietals, 1-1, slightly longer than wide.

Supralabials, 6-6; infralabials, 9-8; prenasal slightly higher than broad; postnasal slightly larger, similarly shaped; loreal small, triangular, higher than wide; azygous scale present just aft to right loreal, nestled between 3rd and 4th supralabials; six oculars, 2 preoculars, 1 subocular, and 3 postoculars; anterior temporals, 3-3. Mental triangular, about as wide as long; anterior chinshield fused with first pair of infralabials, somewhat shorter than posterior chinshields. Second infralabial elongate, extending posteriorly and adjacent to length of posterior chinshield.

Scale rows, 19-19-17; ventrals, 171; subcaudals, 24; anal entire.

The ground color in life, confined to narrow interspaces, was pale salmon. The dorsal blotches were dark chocolate brown, with centers of cinnamon brown. There are 15 dorsal blotches on the body and two on the tail. The body blotches usually reach the first row of lateral scales in a broad contact, relieved in the central margin of the lateral edge by an indentation, tending to give them an hour-glass shape. Many of the blotches totally lack the lateral indentation. In the mid-dorsal region the interspaces are only slightly more than a single scale in length; widening occurs laterally but is not marked. Dark scales occur erratically in the interspaces and are more marked laterally. They are present as well in the lateral indentations. The edges of the blotches bordering the interspaces are dark brown or brownish black.

The head is rather strikingly marked by a blackish interorbital bar covering the frontal, the supraoculars, and the posterior edges of the prefrontals, then extending back to cover most of the parietals. A semivertical band of the same color extends from the eye to the mouth, covering most of the last two supralabials, the posterior edge of the 4th supralabial, and finally contacting the first dorsal blotch penetrates vertically and deeply into the gular region. The snout in front of the interorbital band is grayish brown with a slightly greater concentration of pigment around the nares. The venter is almost immaculately light.

The male paratype is a juvenile with a total length of 217 mm.; tail length, 26 mm.; % tail of total, 11.98; ventrals, 155; caudals, 33. Similarity in pattern of the two snakes is noted in interspace pigment clumping, generally light lateral blotch borders and pigmented parietals, although the parietal spots of the paratype are mushroom-shaped, connected with the interorbital stripe by a stem, generally resembling the spots of *lucidus.* The pattern of the paratype differs in that the dorsal blotches are comparatively shorter; interspaces, longer; 9th, 10th and 11th dorsal blotches with a vertebral light circular macule of same color as ground-

color and interspace, and, indeed, connected with the ground color on the right side of the 11th blotch. There are 13 blotches on the body and two on the tail.

Discussion. In addition to the two individuals of *klauberi,* every example of *fortitus* known to exist in collections was examined, and they are listed as follows: Holotype, AMNH No. 64329♂ from Alamos, Sonora; LMK No. 18167♀ from Guirocoba, Sonora; UCMVZ No. 50740♂ from 13.5 mi. W. Alamos, Sonora; FAS No. 13524♀ from 2 mi. W. Alamos, Sonora. The latter specimen was collected D.O.R. on May 29, 1959, by Albert Maas, David and Ellen Shannon and Dolores Nathan.

It was apparent that the two individuals of *klauberi* had longer frontals than the individuals of *fortitus.* Width-length ratios were, for *klauberi*: FAS 12367, 0.781; FAS 13523, 0.800. For *fortitus*: UCMVZ 50740, 0.967; LMK 18167, 0.950; FAS 13524, 0.928. The holotype of *fortitus* was returned to the American Museum before this character was measured.

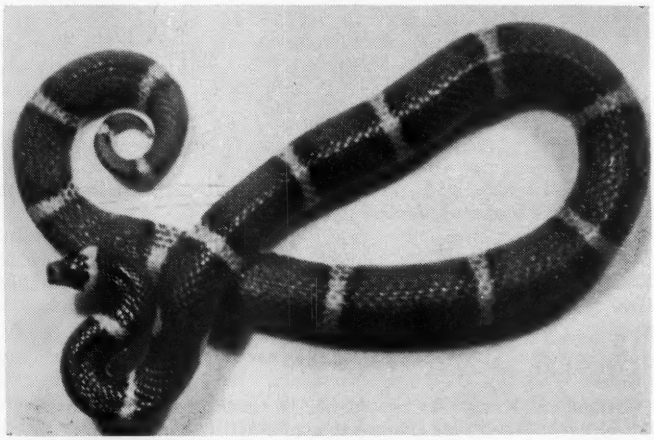

FIG. 1. Holotype of *Phyllorhynchus browni klauberi,* new subsp., FAS No. 12367♀.

The holotype of *klauberi* is more than a hundred millimeters longer than any known published length record for *browni* or *lucidus,* although the length of the male *fortitus* collected by Dr. Zweifel from 13.5 mi. S. Alamos is 410 mm., whereas the female from Alamos (FAS 13524) measures 418 mm.

Some slight conformation to Bogert's[1] suggested south-north gradient in pattern characters is provided by the holotype of *klauberi.* Bogert compared the ratio of dark scales to light by counting the dark and light scales involved in a single row. With data provided by Dr. Klauber[2] for *lucidus* and *browni,* the northernmost subspecies, *lucidus,* was found to have a ratio of 1.23, and *browni,* 1.56 (mean). The counts on *fortitus* were

made on the seventh longitudinal scale row in order to avoid the white circular areas of the blotches, and the ratio obtained was 5.48. While these spots do not occur on the holotype of *klauberi,* the counts were likewise made on the seventh scale row, and a ratio of 6.875 was obtained. It is of some interest that the data obtained, if generally valid for the two subspecies, show a reversal of Gloger's rule of a clinal increase in pigmentation to the north, as recently expressed by Dr. Philip Smith.[3] However, it is not at all certain that the above situation is generally valid for the two subspecies. The paratype of *klauberi* has a band ratio of 2.48, whereas this ratio for the three specimens of *fortitus* is: FAS 13524, 2.68; UCMVZ 50740, 3.60; LMK 18167, 3.22. Nevertheless, if the holotypes of *fortitus* and of *klauberi* represent extremes of their respective subspecies, it is likely that a more representative example of each population would show the presumed clinal relationship.

No conformation for Bogert's suggested south-north increase in ventral counts can be supplied by the available material. These data are summarized as follows:

	ventrals	*caudals*	*Museum No.*
P. b. klauberi	171	24	FAS 12367 ♀
	155	33	FAS 13523 ♂
P. b. fortitus	170	25	FAS 13524 ♀
	171	26	LMK 18167 ♀
	155	34	UCMVZ 50740 ♂
	157	33	AMNH 64329 ♂

The *klauberi* female, with a ventral count of 171, is little less than the mean of 172.3 for female *browni.*[4]

[1]Bull. Am. Mus. Nat. Hist., v. 83, art. 6, p. 354, 1945.

[2]Klauber, L. M., Trans. San Diego Soc. Nat. Hist., v. 9, no. 20, p. 202, 1940.

[3]Herpetologica, v. 12, no. 2, p. 156, 1956.

[4]Klauber, L.M., *loc. cit.*

Acknowledgments: We would like to thank Mr. Charles M. Bogert who generously entrusted the holotype of *Phyllorhynchus browni fortitus* to us for examination. Likewise we thank Drs. L. M. Klauber and Robert C. Stebbins for the loan of their respective and only examples of *fortitus.* Our thanks are also due Mr. Bogert and Ellen C. Shannon for certain helpful comments.

WICKENBURG, ARIZONA

Ecosystematic Relationships of the Salamanders *Desmognathus fuscus auriculatus* Holbrook and *Desmognathus fuscus carri* Neill

By DOUGLAS A. ROSSMAN

The peninsular dusky salamander, *Desmognathus fuscus carri,* was described by W. T. Neill (1951) who characterizes it as a Big Scrub relict, differentiated from *D. f. auriculatus* on the basis of *carri's* smaller adult size, stockier proportions, occasionally brighter dorsal pattern, and lighter venter. *D. f. carri* is thought to be ecologically separated from *auriculatus,* with which it intergrades on the periphery of its range. The new subspecies is stated to be an inhabitant of the margins of clear, cool, calcareous, slightly basic spring runs, while *auriculatus* frequents still, muddy, slightly acidic bodies of water which are high in organic matter. While collecting at the type locality of *carri* at Silver Glen Springs, in the Big Scrub of eastern Marion County, Florida, October 25, 1958, I obtained a number of specimens which appear to agree with typical *auriculatus* from northern Florida and southern Georgia in coloration, proportions and size. On the basis of these observations, a re-evaluation of both the taxonomic status of *carri* and the ecological relationships between *auriculatus* and *carri* seems worthwhile.

Material and Methods—One hundred and forty-nine specimens (75 from the range of *carri,* 67 from northern Florida, and 7 from southern Georgia) were examined. Total length, snout-vent (posterior angle) length, tail length, and head length were measured with vernier calipers, and notes on intensity of pigmentation and nature of color pattern were recorded for each specimen. Tail length/total length ratio (T/TL) was calculated for specimens with complete and unregenerated tails, and head length/snout-vent length ratio (HL/SV) was calculated for virtually all specimens.

Sexual maturity was determined by examination for the presence of secondary sex characters (males—cloacal papillae; females—cloacal folds). Dissection revealed that all females possessed ovarian eggs, those of the mature, gravid females being large and yellowish as compared to the tiny, grayish white eggs of immature females. Due to the extended breeding season (Neill, 1951), not all females are at the same stage of development at any given time, and it is not at all unusual to find even large individuals with only small undeveloped ovarian eggs. Absence of large ripe eggs obviously cannot be used as a criterion of sexual immaturity.

Testes smears were made from a number of males in order to determine the smallest snout-vent length at which mature sperm were present, and whether or not there was a close correlation between the development of cloacal papillae and the appearance of mature sperm. Although the relatively small size of the sample examined renders the results inconclusive, the data at hand would suggest that mature sperm and cloacal papillae develop at approximately the same time. Schwartz (1957) found such a correlation between the appearance of cloacal papillae and sexual maturity in *Plethodon jordani clemsonae.* Highton (1956) has demonstrated that sperm may be absent during part of the year in mature male *Plethodon*

glutinosus. Thus the presence of secondary sex characters appears to be the only reasonably sound basis for considering a specimen sexually mature.

Measurements (in mm.)—The original description states that the average snout-vent length of adult *carri* is usually between 30 to 38; that of *auriculatus* 45 to 60. It further comments that the 15 largest specimens range from 32.5 to 40.3 except for two exceptionally large males which measured 45 and 48, respectively (the holotype measured 41.3). The smallest mature *carri* (DAR 1281 from Marion Co., Fla.) examined by the writer measured 33.5 s-v. Apparently specimens of *Desmognathus* from central Florida may become mature at about 32 or 33 snout-vent. An occasional precocious individual of 30 is not inconceivable. The smallest mature *auriculatus* (UF 2368-9 from Baker Co., Fla.) that I have measured was 35.8 s-v. Thus it appears that there is a difference of only a very few millimeters in the s-v length of *auriculatus* and *carri* at maturation, a difference which could be as easily due to varied environmental conditions as to different genetic makeup. The literature contains a number of examples of similar interpopulation variation in poikilothermic vertebrates (Bailey & Lagler, 1938; Highton, 1956; Valentine, in *ms.*).

In addition to reaching maturity at approximately the same size, both *auriculatus* and *carri* attain a similar maximum size. Table I compares the s-v maxima for specimens from five counties arranged on a north-south axis. The Marion County Big Scrub specimens are listed by locality. Unfortunately, several of the series are rather small and maximum-sized individuals may not be represented by the available samples.

TABLE I

Snout-vent Maxima (in mm.)

Area	Max.
Irwin Co., Ga.	57.5
Baker Co., Fla.	53.5
Columbia Co., Fla.	58.1
Alachua Co., Fla.	57.5
Marion Co., Fla.	
Salt Spring	63.0
Silver Glen Springs	60.0
Juniper Springs	50.0

The fact that 25 of 36 adults (69.4%) collected at Silver Glen Springs exceed 41 mm. snout-vent indicates that the presence of large adults is a normal rather than exceptional occurrence.

Proportions—In the original description it is stated that the tail/total length (T/TL) ratio in *carri* usually ranges from 44-46%, whereas in *auriculatus* it usually exceeds 50%. The specimens examined do not support this statement. Rather they suggest that the two forms are almost identical in this regard (Table II). The Big Scrub localities and the North Florida-South Georgia localities have been respectively lumped for statistical treatment. Standard error of the difference of the means ($S.E._d$) was calculated to be 0.399, which is not statistically significant. There is some evidence indicating a possible north-south cline in this character, the tail becoming proportionately shorter to the south. However, more material from throughout the range of *auriculatus* must be examined to determine the validity of this trend.

TABLE II
Tail/Total Length Ratios (T/TL)

County	No. Spec.	M.	Range
Irwin Co., Ga.	5	49.5	(47.8-50.9)
Baker Co., Fla.	6	47.5	(44.4-50.0)
Columbia Co., Fla.	7	46.8	(45.6-48.3)
Alachua Co., Fla.	7	47.8	(45.1-50.1)
Dixie Co., Fla.	4	47.2	(46.1-48.4)
Marion Co., Fla.			
Salt Spring	5	46.5	(44.9-48.7)
Silver Glen Springs	20	47.0	(44.7-49.5)
Juniper Springs	6	47.7	(44.2-49.0)
Lake Co., Fla.	6	46.8	(45.4-47.6)
North Florida & So. Georgia	29	47.7±0.327	(44.4-50.9)
Big Scrub	37	47.0±0.228	(44.2-49.5)

It was also stated that the head length/s-v (HL/SV) ratio in *carri* usually exceeds 25%, whereas that of *auriculatus* is usually about 20%. The specimens examined indicate that the ratios are almost identical for the two subspecies. $S.E._d$ between the Big Scrub and the North Florida populations was 0.211, which is not statistically significant. Table III presents the HL/SV ratios for all adults in which the head was not too distorted to measure. No clines in this character are indicated.

TABLE III
Head Length/Snout-Vent Ratios (HL/SV)

County	No. Spec.	M.	Range
Baker Co., Fla	11	24.9	(23.8-26.6)
Columbia Co., Fla.	14	24.8	(23.1-26.2)
Alachua Co., Fla.	10	24.1	(22.9-26.0)
Dixie Co., Fla.	6	25.8	(25.1-26.4)
Marion Co., Fla.			
Salt Spring	7	23.9	(22.6-24.8)
Silver Glen Springs	27	25.2	(23.8-26.9)
Juniper Springs	6	25.2	(23.7-26.3)
Lake Co., Fla.	6	24.9	(23.2-26.0)
North Florida	41	24.8±0.148	(22.9-26.6)
Big Scrub	46	25.0±0.151	(22.6-26.9)

No comparison was made with respect to body girth because this character is affected by the condition of the salamander at the time of preservation, the method of preservation, and the nature of the preservative in which it is stored. Consequently it is of dubious diagnostic value.

Coloration—A small portion of the *carri* population was noted as being marked dorsally with an orange longitudinal band, a color pattern not known to exist in *auriculatus*. An illustration of this phase of *carri* appears in the original description and was adapted by Conant (1958) for his field guide. I have been unable to collect or observe any specimens fitting this description. Of the specimens examined those most resembling it are UF 387-5 from Dixie County and UF 2368-3 from Baker County, Florida, both of which have a moderately dark tan dorsal stripe containing many dark spots. The dorsal stripe in life could have had an orange tinge.

Pigmentation of the dorsum was found to be variable in all populations, ranging from that described in the preceding paragraph through greyish brown, moderately dark brown, dark brown, very dark brown to black. In considering animals of similar s-v dimensions, the Big Scrub populations were not found to have proportionately more light individuals than the samples of *auriculatus*. The Dixie County, Florida, population was dominated by specimens with greyish brown dorsums, but the series was small and the pattern and intensity of pigmentation were duplicated in some individuals from each of the other populations (except for a very small series from Irwin County, Georgia). As with the T/TL ratio, there may be a cline involved here, with dorsal pigmentation being most intensely and consistently black to the north. Apparently the intensity of pigmentation increases with size, since late larvae and newly transformed individuals are tan dorsally with two irregular longitudinal rows of tiny dark spots within a well defined dorsal stripe. Those adults which are light enough to reveal a dorsal pattern show an almost complete retention of the pattern of newly transformed specimens.

Some trace of the dorsal spots (usually six pairs) that are so distinct in the newly transformed salamanders is usually present in even the largest and darkest adults. There is considerable individual variation in the size and brightness of these spots, but they are always small and never fused except above the forelimb where fusion of several adjacent spots forms a light line running from the head onto the body. This condition was considered to be characteristic of *carri*. The dorsal spots of Florida specimens are much smaller than those in the spotted race of *fuscus* (possibly *conanti*) which interdigitates with *auriculatus* in western Florida (Carr, 1940, Grobman, 1950; Neill, 1954, 1957; Rossman, 1958). The relationships of the spotted *fuscus* and *auriculatus* in western Florida are not typical of two closely related subspecies, but more closely resemble those of two separate species.

The prominent yellow, orange, or red postocular light patch is mentioned by Bishop (1947) in his discussion of *auriculatus*. In the series examined by the writer it was found to be well developed in the majority of specimens in all populations. It is of interest that in specimens from Salt Spring the lower row of lateral spots was also bright orange.

Ventral pigmentation exhibits considerable individual variation. Every conceivable color pattern between a tan venter mottled with dark brown and the characteristic black venter "salted" with white was encountered. The degree to which the throat region was more lightly pigmented than the remainder of the venter also varied greatly and in neither this characteristic nor in the pigmentation of the rest of the venter did the Big Scrub population appear consistently lighter than North Florida *auriculatus*. Ventral pigmentation is very light in newly transformed individuals and becomes darker as the animal increases in size. Those adults possessing relatively light venters apparently have never had the juvenile pattern obscured by an increase in dark pigment. As indicated above, this phenomenon is not unique to any one population. Neill and Rose (1949) characterize the *auriculatus* from near Augusta, Georgia, as possessing mottled grey bellies. Such a description well fits the smaller Big Scrub individuals and may indicate that considerable local variation exists in this feature.

Ecology—The original description indicated a rather sharp ecological break between *carri* and *auriculatus*, the former being an occupant of slightly basic situations, the latter of slightly acidic. The first series of very large adults collected at Silver Glen Springs was not taken from the sand boils area described by Neill, but from a cypress swamp bordering the headspring on the east. No large individuals were taken from the low shell and gravel mound at the head of the boils area. Although the phenomenon of two subspecies coexisting at the type locality of one of them is hardly a common one in amphibians, the possibility of an ecological separation had to be considered. Consequently, a second trip was made to Silver Glen Springs on November 15, 1958, with the purpose of determining the approximate pH of the two habitats and searching the sand boils area more carefully to see whether or not the absence of large adults was real.

The boils area was found to be slightly more basic in pH (7.6) than the cypress swamp (7.3), but the latter was definitely not acidic. A careful combing of both banks of the spring run, from the source of the boils area down to the swamp surrounding the headspring and its run, revealed large adults. Although not as large as the largest of the cypress swamp specimens, they were notably larger than typical *carri*. Apparently the cover in the area of the boils source does not offer sufficient protection for large dark salamanders which would be conspicuous prey for any predator. The juveniles and young adults would have a decided advantage. In the black muck which surrounds the boils area and reaches its maximum development in the cypress swamp, the adults are not so conspicuous. At and near the head of Juniper Springs, however, there are no extensive muck areas and large and small individuals occur together. At Salt Spring where the only available substrate is muck, both size groups coexist.

Further investigation of the peculiar ontogenetic difference in habitat preference at Silver Glen Springs would undoubtedly be profitable. It would be of interest to know why the smaller salamanders congregate at the mound. In conjunction with this it should be determined whether the adults return to the mound to lay their eggs or the juveniles migrate there from the place of hatching.

Even outside of the Big Scrub, *auriculatus* does not seem to be restricted to an acidic habitat. There is a sizeable population at the Devil's Mill Hopper in central Alachua County where the salamanders inhabit a tumbling, calcareous spring run that is as basic in pH as the sand boils area at Silver Glen Springs. Apparently *auriculatus* is adapted to a number of different microhabitats, the chief requirement being a permanent water supply.

Fecundity—Neill (1951) noted that the number of eggs per clutch is smaller for *carri* (5-6) than for northern Florida *auriculatus* (30-35). One of the two clutches was associated with a 33.5 mm. s-v female which, to judge by its size, had just recently attained sexual maturity. The size of the other female was not mentioned. It has been demonstrated that in *Desmognathus fuscus welteri* increase in body size is accompanied by an increase in the number of eggs (Barbour and Hays, 1957). It seems reasonable to expect a similar condition to exist in *auriculatus*. This belief is partially substantiated by Neill and Rose (1949) who discovered a female *auriculatus* of 40 mm. s-v guarding a clutch of six eggs near Augusta,

Georgia.

Summary and Conclusions—Careful examination of 75 specimens representing the Big Scrub population designated as *D. f. carri* and 74 specimens of *D. f. auriculatus* from northern Florida and southern Georgia has revealed no significant difference between the two populations in size at maturation, maximum size, proportionate tail length, proportionate head length, intensity of dorsal and ventral pigmentation, presence of dorsal spots, size and color of postocular light spot, or ecology. A north-south cline may exist in two of these characters but needs to be substantiated. In view of these facts, *Desmognathus fuscus carri* Neill is relegated to the synonomy of *Desmognathus fuscus auriculatus* Holbrook.

Specimens Examined: FLORIDA: Alachua Co.—no specific locality (UF 3086-6), Devil's Mill Hopper (DAR 1243-1244), Gainesville [UF 173-4, 600 (22)], 4 mi. E Gainesville (UF 1094-6), Haile's Siding (UF 3675), Lake Alice (UF 333), Lake Newnan (UF 55-2, 55-5); Baker Co.—Olustee Experimental Forest [UF 256 (2)], near Taylor (UF 2958), transect R21E [UF 2368 (11)]; Columbia Co.—3½ mi. N Ft. White [UF 4076 (16)]; Dixie Co.—W Manatee Springs [UF 387 (6)]; Hillsborough Co.—Lithia Springs [UF 3036 (2)] paratype; Lake Co.—Alexander Springs (DAR 1264-1268+1); Marion Co.—Juniper Springs (DAR 1275, 1280-1285), Salt Spring (DAR 1276, 1294-1299), Silver Glen Springs (DAR 1271-1273, 1287-1293, 33 unnumbered specimens); Orange Co.—Rock Springs (DAR 1301); Polk Co.—6 mi. S Lakeland [UF 2962 (2), 2963, 7378] paratypes. GEORGIA: Camden Co.—½ mi. S White Oak (UF 7813), Woodbine (UF 2062); Irwin Co.—near Osierfield (DAR 1302-1306).

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LITERATURE CITED

Bailey, Reeve M., and Karl F. Lagler. 1938. An analysis of hybridization in a population of stunted sunfishes in New York. Papers Michigan Acad. Sci., Arts, Letters, 23: 577-606.

Barbour, Roger W., and Rodney M. Hays. 1957. The genus *Desmognathus* in Kentucky. I. *Desmognathus fuscus welteri* Barbour. Amer. Midl. Nat., 58 (2): 352-359.

Bishop, Sherman C. 1947. Handbook of salamanders. Comstock Publ. Co., Ithaca, New York. 555 pp.

Carr, Archie F., Jr. 1940. A contribution to the herpetology of Florida. Biol. Sci. Ser., Univ. Florida Publ., 3 (1): 1-118.

Conant, Roger. 1958. A field guide to reptiles and amphibians. Houghton Mifflin Co., Boston. 366 pp.

Grobman, Arnold B. 1950. The distribution of the races of *Desmognathus fuscus* in the southern states. Chicago Acad. Sci., Nat. Hist. Misc., 70: 1-8.

Highton, Richard. 1956. The life history of the slimy salamander, *Plethodon glutinosus,* in Florida. Copeia, 1956 (2): 75-93.

Neill, Wilfred T. 1951. A new subspecies of dusky salamander, genus *Desmognathus,* from south-central Florida. Publ. Research Div. Ross Allen's Rept. Inst., 1 (3): 25-38.

Neill, Wilfred T. 1954. Ranges and taxonomic allocations of amphibians and reptiles in southeastern United States. Publ. Research Div. Ross Allen's Rept. Inst., 1 (7): 75-96.

Neill, Wilfred T. 1957. Historical biogeography of present-day Florida. Bull. Florida State Mus., 2 (7): 175-220.

Neill, Wilfred T., and Francis L. Rose. 1949. Nest and eggs of the southern dusky salamander, *Desmognathus fuscus auriculatus.* Copeia, 1949 (3): 234.

Rossman, Douglas A. 1958. A new race of *Desmognathus fuscus* from the south-central United States. Herpetologica, 14 (3): 158-160.

Schwartz, Albert. 1957. Variation and natural history of *Plethodon jordani clemonae* Brimley. Copeia, 1957 (2): 94-107.

Valentine, Barry D. Distribution and taxonomy of Mississippi salamanders, with additional notes for Alabama. Unpublished manuscript.

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Hormonal Control of Red Head Coloration in the Five-Lined Skink, *Eumeces fasciatus* Linnaeus

By RICHARD A. EDGREN

During the breeding season adult male individuals of many species of the lizard genus *Eumeces* show a marked red coloration of the head (Taylor, 1936). Fitch (1954) has recently reviewed the ecology and natural history of the five-lined skink, *Eumeces fasciatus* Linnaeus, and has devoted some attention to the development of this breeding coloration. The reddish suffusion appears shortly after the lizards have emerged from hibernation in the spring and fades later on in the season. Fitch feels that the red coloration is an example of a social releaser in the sense that the term was employed by Tinbergen (1948). The red head probably: ". . . facilitates sex recognition and evokes hostile behavior on the part of other males." (Fitch, 1954, p. 50.)

These data suggest that this sexual trait may be under the control of androgenic hormones liberated by the testes during the breeding season. Through the kindness of Dr. Henry S. Fitch of the Department of Zoology, University of Kansas, a series of this species was obtained to test this hypothesis.

MATERIALS AND METHODS

These studies employed five adult female and four adult male *Eumeces fasciatus* that had been captured on the University of Kansas Natural History Reservation, in Douglas County, Kansas. The lizards were divided

into four groups that were maintained in the laboratory in 4000 ml. beakers. The four beakers were placed side-by-side on a laboratory bench so there were probably no significant differences in lighting or temperature. Water was available to the lizards at all times. Three of the five females were treated with testosterone propionate and two of the males received estrone: the remaining two females and two males were untreated and served as controls. The testosterone propionate was administered as a microcrystalline suspension in water and the estrone was dissolved in corn oil. The injections were given on a Monday, Wednesday and Friday schedule; the dose of testosterone was 1 mg. per injection and the dose of estrone 100 μ. In each case the material was contained in 0.05 ml. of fluid, which was injected into the base of the tail of the lizard.

Testosterone injections were begun on April 15, two days after receipt of the lizards from Dr. Fitch. At the time of arrival the males showed a marked suffusion of the red coloration, particularly on the upper and lower labials; however, since it was not until a week later that the coloration reached peak development estrone injections were not initiated until April 20.

At the time of each injection the lizards were inspected for evidence of development of the coloration in the treated females or its regression in the treated males.

RESULTS

Females. Injections were initiated on April 15 and by the 27th definite suffusion of red pigment was obvious on all three of the testosterone-treated lizards. By May 1 the reddish suffusion was as distinct on the treated females as it was on the normal males. Meanwhile the untreated, control females showed no indication of any reddish coloration whatever. Additional injections, beyond May 1, did not appear to affect the condition further. Thus in intact female *Eumeces fasciatus* the first indication of the male type of head coloration was evident after about 12 days of treatment, during which time the lizards had received 5 mg. of testosterone propionate.

Males. The administration of estrone to male animals produced a decrease in intensity of the red coloration, although this decrease was rather subtle, and therefore, somewhat difficult to determine. Injections were begun on April 20 when the color had reached its greatest development. Nine days later, April 29, the two treated animals, which had received 400 μ of estrone over this period, showed considerably less red suffusion than did the control males. By May 6 the red on the controls was also faded, which introduced some subjectivity in the evaluation of these results. However, on May 8, when one of the treated lizards died, the remaining treated male showed appreciably less red than did either of the two controls; the dead animal also had less color.

DISCUSSION

The interpretation of data obtained from experiments that employ the technique of heterologous sex hormone administration is fraught with danger since although the results of such studies may indicate direct hormonal effects, they may also represent the effects of pituitary blockage or peripheral antagonisms between androgens and estrogens. Although the present data are subject to such criticism, certain conclusions seem prob-

able. The administration of androgenic hormone to female *Eumeces fasciatus* stimulated the development of the male type of head coloration. In the normal male animals, the development of the coloration appears to be correlated with testicular activity. Reynolds (1943) has studied the sexual cycle of this species and has found evidence of androgen action on the epididymis and sexual segment of the kidney during February, March, April and May. These studies employed captive individuals, and would appear to extend sexual activities back into what, in the wild, would be the hibernating period. Thus Reynolds' February to May data may be considered to correspond closely to the sexual periods described by Fitch for April and May. This is particularly convincing when one notes that the extratesticular traits listed by Reynolds reached their greatest expression in April and May, when the red head coloration was also most apparent on wild lizards.

The possibility that these effects result from pituitary blockage seems remote. On the females, testoid produced coloration. If this were mediated through blockade of the pituitary-gonadal axis, females would develop the male coloration following ovariectomy or during a quiescent ovarian state.[1] Although data are not available on ovariectomy, females after oviposition, which are certainly not in a follicular, or estrogenic, phase of their sexual cycle, do not show red suffusion. Since estrogens hardly are involved as inhibitors, a direct androgenic action is strongly suggested. In the males, the decrease in coloration that results from estrogen administration is most probably the result of pituitary blockade or peripheral antagonism. The data of the present experiment does not favor either hypothesis.

One may conclude that the development of the red head coloration of the males is probably under the control of androgenic hormones from the gonads.

SUMMARY

Testosterone propionate stimulated the development of a red head coloration in female *Eumeces fasciatus* similar to that observed in breeding males. In males the red coloration appeared to be decreased by estrogen administration. In normal males this head coloration is probably under the control of gonadal androgens.

LITERATURE CITED

Fitch, H. S. 1954. Life history and ecology of the five-lined skink, *Eumeces fasciatus*. Univ. Kansas Publ., Mus. Nat. Hist. 8: 1-156.

Reynolds, A. E. 1943. The normal seasonal reproductive cycle in the male *Eumeces fasciatus* together with some observations on the effects of castration and hormone administration. J. Morph., 72: 331-377.

Taylor, E. H. 1936. A taxonomic study of the cosmopolitan scincoid lizards of the genus *Eumeces*. Univ. Kansas Sci. Bull., 23: 1-643.

Tinbergen, N. 1948. Social releasers and the experimental method required in their study. Wilson Bull., 60: 6-51.

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[1]In mammals this phase would be known as anestrus; I know of no comparable term for non-mammalian species.

NOTES ON A SECOND SPECIMEN OF THE SNAKE *TANTILLA CUCULLATA* MINTON.—*Tantilla cucullata* was described by Minton (1956, Fieldiana, 34:449-452) on the basis of a single specimen from six miles south-southeast of Alpine, Brewster County, Texas. It differs from all other Texan forms of the genus by the presence of an almost uniformly black head, a high number (167) of ventral scutes, and a high number (82) of subcaudal scales. A snake (Texas Nat. Hist. Coll. 23188) tentatively regarded as a second specimen of *T. cucullata* was collected by the junior author in Green Gulch of the Chisos Mountains, Brewster County, Texas, on August 1, 1957. The snake was found alive about 9:30 p.m. on a black-top road which was wet and cool from a recent shower.

The Green Gulch specimen is a male with measurements and scale counts as follows: total length, 514 mm. (cf. 336 mm. in the type); tail, 117 mm.; 15-15-15 dorsal scale rows; 169 ventrals; 72 (cf. 82 in the type) subcaudals; anal divided; one preocular; two postoculars; seven supralabials; six infralabials; 1-1 temporals; third and fourth supralabials entering eye. The chin shields are as broadly in contact with the mental as they are in most specimens of *Tantilla atriceps* from Trans-Pecos Texas. The dark coloration of the parietals extends posteriorly over four dorsal scales (cf. 3½ in the type). The Green Gulch specimen agrees with the type of *cucullata* in the presence of a black hood and in approximate number of ventrals, but differs in the amount of contact between the chin shields and mental, in the number of subcaudals, and in size. After comparing the two specimens, Dr. Robert F. Inger has stated that he believes them to be of the same species, but he has found that the Green Gulch specimen has a proportionately shorter frontal than does the type. The differences which exist between the Green Gulch specimen and *cucullata* are as great as those which exist between *cucullata* and other species of *Tantilla* from the Big Bend region. Conceivably, then, the Green Gulch specimen could be named as another new species with every claim to validity possessed by *cucullata*. The authors feel, however, that such a step would be unwise and, for convenience, prefer to identify the Green Gulch specimen as a second specimen of *cucullata*. This is done with the reservation that *cucullata*, like all species based on a single specimen, must await the proof of numbers of specimens before it can be considered a valid species.

In his description of the type, Minton has allied *cucullata* to *nigriceps* primarily on the supposition that the head pattern of *cucullata* would be more easily derived from that of *nigriceps* than from any other species. Examination of two specimens of *nigriceps* from Trans-Pecos Texas (Tex. Tech, Univ. Tex.), 19 specimens of *nigriceps* from northwest Texas (Tex. Tech), 13 specimens of *atriceps* from the Chisos Mountains (Degenhardt Coll.), and 12 specimens of *atriceps* from other areas in Trans-Pecos Texas (Univ. Tex.) show that the black hood of *cucullata* is latent in both *nigriceps* and *atriceps*. The head pattern of *atriceps* is rather

variable, a characteristic previously noted by Murray (1939, Contr. Baylor Univ. Mus., 24:5). In our specimens, the post-parietal extension of the black cap varies from 0 to 3 dorsal scales. The gular region, the angle of the jaws, and the labials are particularly variable. In some individuals, these areas are uniformly light. In others, one or two of these areas are shaded with dark pigmentation, and, in still others, all three areas are darkly shaded to produce a hood similar to that of *cucullata.* None has the hood as dark as it is in *cucullata,* but the pattern is present and the only difference is in the intensity of pigmentation. Furthermore, the number of subcaudals of the Green Gulch specimen is within the known range of subcaudals of *atriceps* (our specimens have a maximum of 73 subcaudals), and the amount of contact between the mental and chin shields of the Green Gulch specimen is typical of *atriceps.* The amount of contact between the mental and chin shields of the *cucullata* type might be considered intermediate between *atriceps* and *nigriceps.*

Minton describes the terrain of the type locality (grassland in the southeastern foothills of the Davis Mountains) as ". . . hilly but not especially rugged." The site in Green Gulch where the second specimen was collected is in the Piñon-Pine—Juniper—Oak association, and is extremely rocky with steeply sloping sides. The type locality and the Green Gulch locality are separated by about a hundred miles and are in separate biotic districts. The collection of the second specimen indicates that the range of the species is greater than that anticipated by it by Minton. It possibly ranges throughout both the Davis Mountains and Big Bend biotic districts (of Milstead, in press) although it may be restricted to the mountains of those districts. Both specimens were collected at altitudes greater than most areas of the Chihuahuan Desert, and where rainfall is also greater. Both specimens were collected while active immediately following rain.

Terrestrial vertebrates frequently recorded in the Piñon-Pine—Juniper—Oak association of Green Gulch by the senior author during his studies there from 1955 through 1958 include: *Syrrhophus marnocki, Eumeces brevilineatus, Gerrhonotus liocephalus, Tantilla atriceps, Crotalus lepidus, Sylvilagus floridanus, Neotoma albigula, Sigmodon ochrognathus,* and *Odocoileus virginianus.* Two of the rarest snakes of the Chihuahuan Desert, *Lampropeltis alterna* and *Trimorphodon vilkinsoni,* have also been recorded from approximately the same locality in the same association.

Thanks are due Dr. Robert F. Inger, Chicago Natural History Museum, for comparing the second specimen with the type, and Dr. Hobart M. Smith, University of Illinois, for examining the second specimen. Acknowledgment is also due Dr. W. Frank Blair for loan of specimens of *Tantilla* in the Texas Natural History Collection of the University of Texas, and Floyd E. Potter, Jr. for providing pertinent information about these specimens.—*William G. Degenhardt, Dept. of Biology, A. and M. College of Texas, College Station, Texas, and William W. Milstead, Dept. of Biology, Texas Technological College, Lubbock, Texas.*

ADDITIONAL MELANISTIC SPECIMENS OF *NATRIX RIGIDA*.—Etheridge (Copeia, 1950 (4): 321) reported two juvenile melanistic *Natrix rigida* from St. Tammany Parish, Louisiana. These are probably TU 5504 and TU 6037 in the Tulane Collection. Three additional all black *N. rigida* are also in the Tulane Collection. One is a juvenile (TU 2593), 196 mm. in total length, collected by Percy Viosca on August 5, 1924, at Mandeville, St. Tammany Parish, Louisiana. Another is a large, adult female (TU 17296), 798 mm. in total length, taken April 17, 1958, in New Orleans, Orleans Parish, Louisiana, by Morris Rogers. The last, a young adult male (TU 17345) captured by Paul Hatrel in October, 1958, near Violet, St. Bernard Parish, Louisiana, is 482 mm. in total length.

Extensive collecting by Tulane field crews and other herpetologists along the Gulf Coast has failed to reveal additional populations of melanistic *N. rigida*. Apparently, melanism in *rigida* is rare or unknown outside of southeast Louisiana.

Identifications were verified by Roger Conant.—*C. Robert Shoop, Department of Zoology, Tulane University, New Orleans, Louisiana.*

OPHIOPHAGY IN *LEPTODEIRA*.—Duellman (A Monographic Study of the Colubrid Snake Genus *Leptodeira*) lists *Leptodeira* as feeding upon anurans and lizards. He makes no mention of snakes. Wright and Wright, 1957, list lizards, snakes, frogs, mice, fish, and salamanders, but give no further references about snakes in the text. Ditmars, 1939, records small lizards, frogs, and mice as being eaten. Schmidt and Davis, 1941, mention small birds, mammals, and lizards, but give nothing specific about either birds or mammals. Wright and Wright are the only authorities consulted that list snakes as being food of this genus.

On July 24, 1959, a captive *Leptodeira* (believed to be *L. annulata rhombifera*, although this has not been verified), which arrived in Rochester, New York, about June 17, 1959, in a banana shipment, killed and ate a hatchling *Lampropeltis doliata triangulum*. The *Leptodeira* is 19¾ inches/4 inches (total/tail); the *Lampropeltis*, about 7 inches overall. The *Lampropeltis* was engulfed sometime between 7 P.M. and 10 P.M., probably after dark; this is consistant with past feeding habits. The actual ingestment was not observed. At 10 P.M., the temperature was 84° F.

Since July 7, the *Leptodeira* had refused all food. This appeared to support Wright and Wright's observance of a *L. s. septentrionalis* not eating during the two hottest months (presumably July and August), but this incident disagrees with their observation, possibly because of the different species involved. In the past, my specimen has accepted 1 *Anolis*, 1 baby *Bufo americanus*, and 1 small *Rana pipiens*. All were eaten sometime after midnight, but before morning.—*Phil Skehan, Jr., 624 Lake Road, Webster, New York.*

Additional Remarks on Extra-uterine Migration of Ova in Turtles

By DONALD W. TINKLE

Legler (1958) has demonstrated that in box turtles and in a few individuals of other reptile species, eggs ovulated from one ovary may reach the contralateral oviduct by trans-coelomic migration. This transfer, also reported in the ribbonsnake (*Thamnophis sauritus proximus*) by Tinkle (1957), is inferred to have occurred when the number of ovulation scars in one ovary differs from the number of eggs in the oviduct on the same side.

Legler (op. cit.) found that eight of fourteen (57%) of *Terrapene ornata* and two of 16 (13%) *Terrapene carolina* showed evidence of ovular migration. The data reported herein were obtained in a recent study of the reproductive tracts of 129 *Sternothaerus odoratus* from all areas of the United States. Many of these were immature and others were not collected during the reproductive season. Thirty-four individuals contained oviducal eggs; in twenty-one of these accurate counts of lutea could be made (Table 1).

Twelve of 21 (57%) turtles showed extra-uterine migration of ova. The specimens were arbitrarily divided into two size groups, those with a carapace length of 80 millimeters or less and those greater than 80 mm. The percentage of transfer was higher (62%) in the larger individuals than in the smaller (50%), but the samples are probably not large enough to say with certainty that body size is correlated with per cent of transfer.

Legler (op. cit.) suggested that transfer might result when an oviduct simply became filled with ova from the ovary on its same side so that additional ovulated eggs were forced to the contralateral oviduct. If this phenomenon occurred, it would seem that the oviduct with the greatest number of eggs should have gotten them from the ovary on the same side. Therefore, there should be a greater number or corpora lutea on the "filled" than on the "unfilled" side, assuming that the side with the greatest number of eggs is the filled side.

Of the 21 turtles, 10 showed a greater number of eggs in one oviduct than in the other. In six of these there were more corpora lutea on the "filled" side, while in four there were more on the "unfilled" side. In the eleven cases in which there was an equal number of eggs in each oviduct, the corpora lutea were predominantly in the left in four, the right in two and equal in five. Considering only those six instances in which it was clear that an extra-uterine transfer had occurred and in which there was also an unequal number of oviducal eggs between the two sides, in four there was a greater number of lutea on the unfilled side than on the filled side, while in two the reverse was true.

These data do not support the idea that filling of an oviduct is important in trans-coelomic transfer, but instead indicates that the phenomenon is due primarily to chance.

Of 50 eggs from females in which some ova were involved in trans-coelomic transfer, 30 (60%) went to the oviduct on the same side with the ovary from which they were ovulated, while 20 (40%) went to the contralateral oviduct. These data do not support the idea of filling as important in transfer because in every instance in which only two eggs were

Table 1. Numbers of corpora lutea, eggs and preovulatory follicles in *Sternothaerus odoratus* on the right and left sides of the body. Carapace length is in millimeters.

Carapace	*Left*			*Right*		
length	Lutea	Eggs	Follicles	Lutea	Eggs	Follicles
71	2	1	0	0	1	0
72	1	1	?	1	1	?
73	0	1	1	2	1	0
76	1	1	0	2	2	4
76	1	1	0	1	1	0
79	2	2	2	1	0	1
79	2	1	1	4	2	1
80	2	1	0	0	1	0
83	2	1	0	0	1	2
84	1	1	1	1	1	0
89	2	2	2	2	2	0
89	3	1	1	0	2	3
90	1	2	4	3	2	3
92	2	2	0	1	1	4
92	2	2	1	2	2	3
99	1	2	4	5	4	3
99	2	3	2	3	2	5
100	4	3	6	2	3	1
100	5	2	4	2	4	6
113	6	0	?	1	7	?
116	2	2	13	4	4	0

ovulated from the same ovary, one of the pair passed to the contralateral oviduct. It would seem that one oviduct could easily hold two eggs.

Legler (op. cit.) also suggests that a better weight balance may be achieved by this ovular migration. It is doubtful that a weight imbalance on one side or the other of a sternothaerine turtle is of great importance because of their bottom-crawling and inshore feeding habits which do not necessitate much swimming or much maneuverability when swimming is necessary. A balance might also be achieved by having the greater number of ovulatory follicles in the side opposite the greater number of oviducal eggs. Of nine individuals with an unequal distribution of eggs, the greatest number of large preovulatory follicles was on the same side in five, the opposite in four.

Neither left nor right ovary was consistently more productive than the other as is often true in reptiles, particularly snakes. The number of ovulation scars in each ovary was equal in 25% of the turtles, whereas the left was more productive in 37.5% and the right in the same percentage.

Literature Cited

Legler, John M. 1958. Extra-uterine migration of ova in turtles. Herpetologica 14 (1): 49-52.

Tinkle, Donald W. 1957. Ecology, maturation and reproduction of *Thamnophis sauritus proximus*. Ecology 38 (1): 69-77.

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TWO LARGE EGG CLUTCHES OF THE BROAD-HEADED SKINK, *EUMECES LATICEPS*.—Data regarding the maximum number of eggs deposited by *Eumeces laticeps* Schneider are comparatively scarce in the literature. The largest numbers previously recorded are reported by Martof (*Herpetologica,* 1956, 12: 111-12), who examined three clutches of 15, 16, and 13.

On June 27, 1959, during the course of a museum collecting trip, Messrs. Perry Rogers and David E. Whitehead collected a female guarding a clutch of 17 eggs under a rotting log, 2 mi. N.W. Swindell Fork, Hyde Co., N.C. Measurements were taken two days later, the eggs averaging 13x9 mm.

Earlier, on June 12, 1959, a large female *laticeps* (NCSM 59-6-1), 279 mm. total length, collected 6 mi. S. Creedmore, Granville Co., N.C., was discovered to contain 22 unlaid, yet well developed eggs, measuring only slightly less than those of the Hyde Co. example. Presumably all would have been deposited.—*W. M. Palmer, North Carolina State Museum of Natural History, Raleigh.*

SYSTEMATIC STATUS OF TWO MEXICAN SPECIES OF THE GENUS *GYALOPION* COPE.—Among the reptiles of the Dyfrig McH. Forbes collection is a female of the secretive genus *Gyalopion* from El Dorado, Sinaloa. This specimen, deposited in the AMNH, is intermediate in color and pattern between *G. quadrangularis* (Günther) and *G. desertorum* (Taylor). The importance of this specimen has led us to review relationships of these two nominal species.

G. desertorum is known from southern Sonora and northern Sinaloa; *quadrangularis* is known from three localities in central Sinaloa. El Dorado lies between the known distributions of the two species.

Nine *desertorum* and three *quadrangularis* have been reported in the literature. Bogert and Oliver (1945, Bull. AMNH, 83 (6): 303-425) and Duellman (1957, Herpetologica, 13 (3): 237-240) suggested that *quadrangularis* and *desertorum* may prove to be conspecific.

An examination of available specimens shows no significant populational differences in the number of ventrals, caudals, or blotches on the body or tail, or in the anal plate (Table 1). Authors have separated these two forms and we separate them, on the basis of color, pattern, and the presence (*desertorum*) or absence (*quadrangularis*) of the loreal. The ground color is brownish to brownish-red in *desertorum,* brownish-red in the El Dorado specimen, and brick-red in *quadrangularis.* The dorsal body blotches extend to edge of ventrals in *desertorum,* whereas in *quadrangularis,* following the nuchal spot the first two blotches extend to the second dorsal row and the rest are mid-dorsal and only six to eight rows wide. The El Dorado specimen is intermediate: all blotches extend to the second dorsal row. The loreal is absent in all known specimens of *quadrangularis* and in the El Dorado specimen, but present in all known specimens of *desertorum.* Bogert and Oliver (op. cit.) and Milstead (1953, Texas J. Sci., 5 (3): 348-379) suggested that in the genus *Thamnophis* the presence or absence of the mid-dorsal stripe may be controlled by a single genetic factor and in such case could not show intermediacy: the loreal in *Gyalopion* may be similarly limited in variation.

Table 1. Variation in certain meristic characters of *G. q. quadrangularis* and *G. q. desertorum*.

Locality So=Sonora; Si=Sinaloa	Sex	Ventrals	Caudals	Body Blotches	Anal Plate
quadrangularis desertorum					
Guaymas, So (EHT-HMS 4576)*	♂	131	26	32	E
Alamos, So (AMNH 64240)	♀	127	30	28	E
Navajoa, So (MVZ 50741)*	—	—	—	30	—
Guiracoba, So (MVZ 50742)*	—	—	—	31	—
Guiracoba, So (AMNH 63718)	♂	127	32	29	E
Guiracoba, So (AMNH 63719)	♂	129	27	29	E
Ahome, Si (RTM 326)*	♂	130	29	27	E
Ahome, Si (RTM 335)*	♀	133	27	29	E
Ahome, Si (RTM 352)* intergrade	♂	128	29	29	E
El Dorado, Si (AMNH)	♀	128	22	26	E
quadrangularis quadrangularis					
24 mi N Mazatlán, Si (UMMZ 11481)	♀	125	26	32	E
4 mi N Mazatlán, Si (UMMZ 11480)	♂	119	23	25	E
Presidio, Si (not known)*	—	129	25	26	D

*We have not examined these specimens. Data are taken from Taylor (1936, Proc. Biol. Soc. Washington, 49: 651-652), Bogert and Oliver (op. cit.), Zweifel and Norris (1955, Am. Mid. Nat., 54 (1): 230-249), and Günther (1893, Biologica Centrali-Americana, Rept., p. 99).

Because all characters other than the loreal either intergrade (color, pattern) or show no significant difference (scale counts), we regard *G. quadrangularis desertorum* (Taylor) appropriate for the northern population and *G. q. quadrangularis* (Günther) for the southern population.

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